PAGE'S WEEKLY.—August 11, 1905. Thin Paper Copy for Circulation Abroad.

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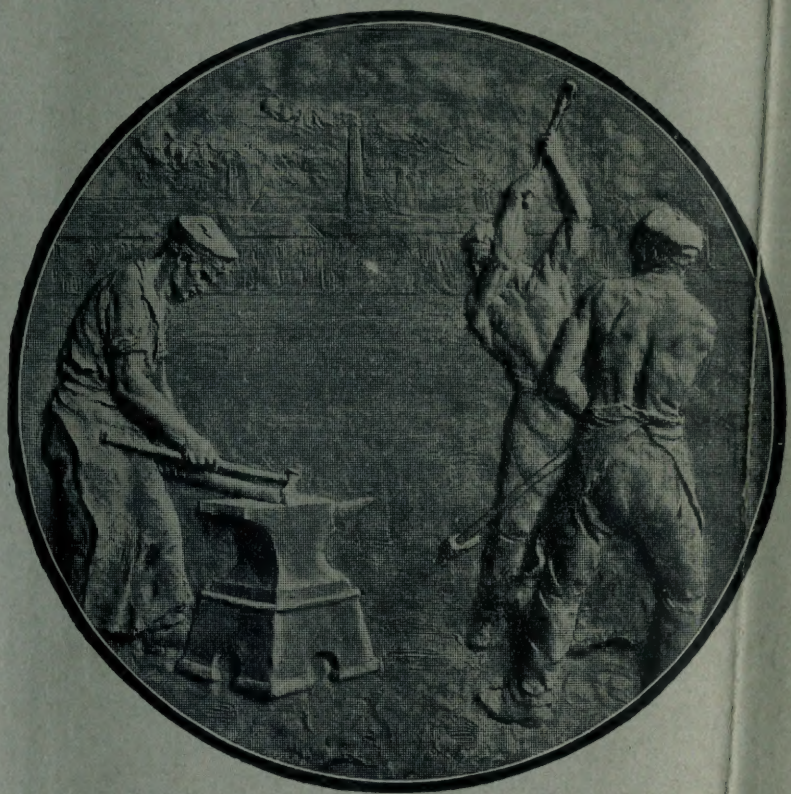
PAGE'S WEEKLY



ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

FRANCE, Paris: 22, Rue de la Banque.
GERMANY, Berlin: 13, Unter den Linden.
RUSSIA, St. Petersburg: 14, Nevsky Prospect.
ITALY, Rome: 307 Corso.
AUSTRIA, Vienna: Kärntnerstrasse, nr. 30.

INDIA, Calcutta: Thacker, Spink & Co.
" Bombay: Thacker & Co., Ltd.
SOUTH AFRICA, Cape Town: Gordon & Gotch.
JAPAN, Yokohama: Kelly & Walsh, Ltd.
NEW ZEALAND: Gordon & Gotch, Ltd.

CANADA: Montreal News Company.
UNITED STATES, New York: International News Co.
" Chicago: Subscription News Co.
AUSTRALIA, Melbourne: Gordon & Gotch.
STRAITS SETTLEMENTS, Singapore: Kelly & Walsh, Ltd.

PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY

Miscellaneous

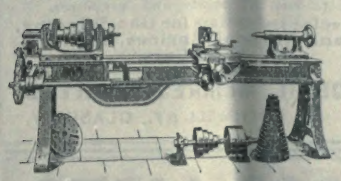
THE BRITISH ADVERTISER SERVICE BUREAU,

Queen Anne's Chambers, Westminster,
Specialises in Advertising for Engineers.
CAN IT ASSIST YOU?

TRANSPORTERS.

See our Advertisement appearing Sept. 1st.

TEMPERLEY TRANSPORTER CO.,
72, Bishopsgate Street Within, LONDON, E.C.
Telephone: 365 London Wall. Telegrams: "Transumo."



HIGH-CLASS
MACHINE TOOLS
In stock for immediate delivery.

THOS. W. WARD, L^D.
Albion Works,
SHEFFIELD.

STONE BREAKERS,

GRAVEL WASHERS, ETC.
SAMUEL PEGG & SONS, Engineers,
LEICESTER, England.

SEND FOR ILLUSTRATED CATALOGUE.

WEST PASCAGOULA CREOSOTING WORKS,

WEST PASCAGOULA, MISS., U.S.A.

Situated on Pascagoula Bay and on the line of the Louisville and Nashville Railroad. These works have been in operation for more than twenty-six years. ORDERS for Creosoted Piles, Telegraph Poles, Cross Arms, Electric Conduits, Paving Blocks, Sawed Tiles, and Timber PROMPTLY EXECUTED. New cylinders, 115 ft. long. Capacity, one million feet per month. A.B.C. Code used. Cable address: Pierre, West Pascagoula, Miss.—Address, JNO. B. LINDSEY, Superintendent.

J. TOMEY & SON'S
EUREKA GAUGE GLASS

ESTABLISHED 1853
ASTON BIRMINGHAM.

A NEW GAUGE GLASS.
Samples, Lists, and Testimonials on application

"S. H. P."

Tested to 350lb. Steam Pressure. **For High Pressure Boilers.**

BRETT'S PATENT LIFTER CO., LTD.
COVENTRY, ENG.

Speciality—

FORGING PLANT.

See our Advertisement appearing Sept. 1st.
SEND FOR LATEST CATALOGUE.

WALTER SCOTT, LTD.,

LEEDS STEEL WORKS, LEEDS, ENGLAND.

MANUFACTURERS OF . . .

Rolled Steel Joists, Channels, etc.

Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.

Speciality: TRAMRAILS.

WELDED AND RIVETED STEEL PIPES.

THOMAS PIGGOTT & CO., LTD., SPRING HILL, BIRMINGHAM. **Send for Catalogue.**

HEAD, WRIGHTSON & CO., LTD.,

STOCKTON-ON-TEES,
for all kinds of
Colliery Plant & Mining Machinery.

SHONE PNEUMATIC EJECTORS

FOR RAISING SEWAGE, SLUDGE, WATER, &c.
Air Compressing Machinery
FOR ALL SERVICES.

HUGHES & LANCASTER

47, VICTORIA STREET, LONDON, S.W.

Rochester Card
Bundy Key
Signature
Journey
Speed
} **RECORDERS.**

For further particulars . . of our . . see our whole page Ad. on Sept. 1st.

TIME RECORDERS

RECORDERS, LTD., 171, Queen Victoria Street, LONDON, E.C.

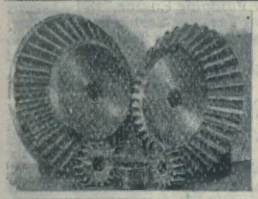
PAGE'S WEEKLY

Miscellaneous

"ZECO" Brand.

Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.



Rawhide Gears

A SPECIALITY.

Also all kinds of Metal Gearing.

AD. AHLERS,

Whitley Bay, Newcastle-on-Tyne.

HIGH-CLASS NON-CORROSIVE

LUBRICATING OILS AND SOLIDIFIED LUBRICANTS.

(Castor, Lard, Olive, Neatsfoot, and Linseed Oils, Tallow, &c.)

RELIANCE LUBRICATING OIL CO.,

19 & 20, Water Lane, Great Tower Street.

LONDON, E.C.

Also at GLASGOW, HULL, BRISTOL, AND NEWCASTE-ON-TYNE.

MALLEABLE IRON & STEEL CASTINGS FOR ENGINEERS & TOOL MAKERS

TO MACHINE CLEAN & BRIGHT ALL OVER.

PARKER FOUNDRY CO. DERBY

ON ADMIRALTY LIST.

DESTRUCTORS and CLINKER MACHINERY.

Horsfall Destructor Co., Ltd., Armley, Leeds.

Telegrams: "DESTRUCTOR." Telephone: 2006.
Codes: A.B.C. (5th Edition) and Leiber's.

Refuse Destructors.

Write for particulars to:—

HEENAN & FROUDE, LIMITED,

4, Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.

A BUSINESS FOR YOU or YOUR SON.

Chips and Saw-dust FIRELIGHTERS.

GLOVER'S PATENT MACHINERY

ENORMOUS Saves 12 to 20 Men's Work. **PROFITS**

M. GLOVER & CO., Saw Mill Engineers, **LEEDS.**

BERTRAMS, Ltd.,

Sciennes, **EDINBURGH.**

MACHINE TOOLS.

See Next Week.

RUBBER STAMPS and ACCESSORIES —

DATING, TIMING & NUMBERING STAMPS

RUBBER STAMP COMPANY

The Commercial Stamp Makers

BIRMINGHAM.

SPECIAL QUICK DRYING AND OPAQUE INKS.

EDGAR ALLEN & CO.,

Limited,

Sheffield.

TRAMWAY MATERIAL.

IN ALLEN'S

IMPERIAL

MANGANESE STEEL.

PAGE'S WEEKLY

Contracts

CONTRACTS.

MERTHYR TYDFIL URBAN DISTRICT COUNCIL.

REFUSE DESTRUCTOR PLANT.

The Council invite TENDERS from experienced makers of Refuse Destructor Plant for the ERECTION of PLANT capable of effectually burning 120 tons of refuse per day, together with all buildings and contingent works connected therewith.

The Council have selected three alternative sites, and copies of the site plans, together with "General Conditions and Particulars for the guidance of Contractors tendering," may be obtained upon application to T. FLETCHER HARVEY, Esq., Engineer and Surveyor to the Council, upon payment of a fee of £3 3s., which will be returned upon receipt of a *bona fide* Tender.

The Council do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Destructor Plant," must be delivered to T. Aneuryn Rees, Esq., Clerk to the Council, on or before September 1st, 1905.

T. FLETCHER HARVEY,
Engineer and Surveyor to the Council.

Town Hall, Merthyr Tydfil,
June 16th, 1905

MUNICIPAL BOARD OF MUSSOORIE, INDIA.

ELECTRIC LIGHTING AND WATER WORKS SCHEME.

The Municipal Board of Mussoorie, India, is prepared to receive

TENDERS FOR THE SUPPLY,

DELIVERY, and ERECTION at sites, in complete working order, of the following plant:—

(*a*) Steel Power Pipes; (*b*) Water Motors; (*c*) Alternators with Exciters; (*d*) Switchboards with Instruments and Apparatus; (*e*) Transformers; (*f*) Induction Motors; (*g*) Pumps; (*h*) Workshop Machines.

Also for the SUPPLY and DELIVERY of the following:—

(*a*) Bare Copper Wire for Overhead Mains; (*b*) Insulators and Lightning Arresters; (*c*) Arc and Incandescent Lamps; (*d*) Telephone Equipment; (*e*) Workshop Tools; (*f*) General Stores.

Specifications, Form of Tender, and General Conditions can be obtained on application to the undersigned on payment of a deposit of Rs. 75 (£5), which amount will be returned on receipt of a *bona fide* Tender. Additional copies may be obtained on payment of a further fee of Rs. 5 (6s. 8d.) per set, which will not be returned.

The Firm whose Tender is accepted will be required to find two sureties to the satisfaction of the Municipality, and to enter with them into a contract to be prepared by the Municipality, and to contain such clauses as it may think necessary.

Sealed Tenders, on the prescribed form, endorsed "Tender for Electric Lighting and Water Works Scheme," should be addressed to the Chairman, Municipal Board, Mussoorie, India, and must be delivered to him on or before Monday, October 23rd, 1905.

The Municipality does not bind itself to accept the lowest or any Tender, nor will it consider any Tender that is not for the whole of the Plant and Material.

By order,
C. H. SHANAN,
Assoc. M.Inst.C.E., A.M.I.E.E., A.M.I.Mech.E.,
Municipal Electrical Engineer.

Municipal Office, Mussoorie, U.P., India,
June 14th, 1905.
Telegraphic Address: "Shanan, Mussoorie."

COUNTY BOROUGH OF WOLVERHAMPTON.

TETTENHALL PUMPING STATION EXTENSIONS.
CONTRACT No. 2.

The Corporation of Wolverhampton are prepared to receive TENDERS for a VERTICAL TRIPLE-EXPANSION PUMPING ENGINE and OTHER WORK connected therewith from engine builders who will undertake to pay the rate of wages and observe the hours of labour recognised and agreed upon between the Trades Unions and the Employers respectively in the locality in which the work is to be performed, or such a rate of wages or hours as are equivalent or approximate thereto.

A copy of the Specification and Form of Tender may be obtained from Mr. E. A. B. WOODWARD, Waterworks Engineer, Town Hall, Wolverhampton, upon payment of the sum of Five Pounds, which amount will be returned to every engine builder who submits a *bona fide* Tender, but not otherwise.

Each Tender must be enclosed in a sealed cover addressed to "The Chairman of the Water Committee," and endorsed "Pumping Machinery," and delivered at my office on or before Friday, the 1st day of September next.

The right to decline the lowest or any Tender is reserved to the Corporation.

HORATIO BREVITT,
Town Clerk.

Town Hall, Wolverhampton,
July 4th, 1905.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

AMENDED ADVERTISEMENT.

SEWAGE WORKS.—CONTRACT No. 1.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the Council invite TENDERS for:—

Supplying and Fixing Gas Pumping Engine, Suction Gas Plant and Sewage Pumps at their Sewage Pumping Station.

Specification and Form of Tender can be obtained on application to the undersigned.

The person or firm whose Tender is accepted will be required to enter into a written contract, and to provide two eligible sureties.

Sealed Tenders, endorsed "Tender for Pumping Engine," to be sent to me, the undersigned, by 4 o'clock p.m. on Tuesday, September 12th, 1905.

The Council do not bind themselves to accept any Tender.

By order,
THOS. SWATHERIDGE,
Clerk to the Council.

Council Offices, 7, North Street, Bishop's Stortford,
July 21st, 1905.

COUNTY BOROUGH OF BURY.

TO REFRIGERATION ENGINEERS.

The Corporation of Bury are prepared to receive SCHEMES and TENDERS for the ALTERATIONS required in connection with their ICE-MAKING PLANT and COLD STORES at the Abattoirs, Bury.

Conditions, Specifications, and Forms of Tender may be obtained from Mr. ARTHUR W. BRADLEY, Assoc.Mem.Inst.C.E., Borough Engineer and Surveyor.

Sealed Tenders, endorsed "Ice Plant," and addressed Chairman, Abattoirs Sub-Committee, must be delivered at my office not later than the 19th day of August next.

JOHN HASLAM,
Town Clerk.

Municipal Offices,
Bank Street, Bury,
July 6th, 1905.

SELBY URBAN DISTRICT COUNCIL.

NEW WATERWORKS.

PUMPING MACHINERY.—CONTRACT No. 6.

TENDERS are hereby invited for the CONSTRUCTION, DELIVERY, and ERECTION of DUPLICATE PUMPING MACHINERY in connection with the above works, comprising Boilers, Triple-expansion Engines, Surface Condensers, Force Pumps, Head Gear, and Borehole Pumps, with a capacity equal to raising 32,000 gallons per hour under a head of 310 ft.

Copies of the Plans and Specifications will be supplied on application to the Engineers, Mr. PERCY GRIFFITH, M.Inst.C.E., 54, Parliament Street, Westminster, S.W., and Mr. BRUCE McGREGOR GREY, Assoc. M.Inst.C.E., Council Offices, Selby, Yorkshire, on payment of £5, which will be returned to all contractors who shall submit a *bona fide* Tender for the work on or before the 28th day of August, 1905.

Tenders must be made on the form provided, and delivered under seal to the undersigned by the date above named.

Every Tender must state the periods required respectively for the delivery and the erection of the machinery, also the guaranteed duty of the engines.

The Council do not bind themselves to accept the lowest or any Tender.

By order of the Council,
(Signed) J. H. BANTOFT,
Clerk to the Urban District Council.

Council Offices, Selby, dated the 25th of July, 1905.

MUNICIPAL BOARD OF MUSSOORIE, INDIA.

WATER WORKS SCHEME.

The Municipal Board of Mussoorie, India, is prepared to receive

TENDERS FOR THE SUPPLY AND

DELIVERY of the following:—

(*a*) Pipes; (*b*) Tees; (*c*) Cross Pieces; (*d*) Reducers; (*e*) Bends; (*f*) Bends and Collars; (*g*) Sluice Valves and Stop Cocks; (*h*) Ball and Non-return Valves.

Specifications and Form of Tender can be obtained on application to the undersigned, on payment of a deposit of Rs. 45 (£3), which amount will be returned on receipt of a *bona fide* Tender. Additional copies may be obtained on payment of a further fee of Rs. 3 (4s.) each, which will not be returned.

The firm whose Tender is accepted will be required to deposit the sum of Rs. 1500 (£100) in a bank, and the receipt, endorsed in favour of the Chairman, must be forwarded with the Tender. This amount will be forfeited on the failure of the Tenderer to execute a formal contract bond within two months of the acceptance of his Tender.

Sealed Tenders, on the prescribed form, endorsed "Tender for Water Works Scheme," should be addressed to the Chairman, Municipal Board, Mussoorie, India, and must be delivered to him on or before Monday, October 9th, 1905.

The Municipality does not bind itself to accept the lowest or any Tender.

By order, C. H. SHANAN,
Assoc.M.Inst.C.E., A.M.I.E.E., A.M.I.Mech.E.,
Municipal Electrical Engineer.

Municipal Office, Mussoorie, U.P., India,
June 14th, 1905.
Telegraphic Address: "Shanan, Mussoorie."

PAGE'S WEEKLY — Contracts and Appointments Open

EAST INDIAN RAILWAY.—The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of :—

(1) STEEL FLAT-FOOTED RAILS and FISH-PLATES,
(2) BUILT-UP CROSSES and SWITCHES,
(3) PORTLAND CEMENT,

as per specification to be seen at the Company's offices.

Tenders are to be sent to the undersigned, marked "Tender for Flat-footed Rails and Fish-plates," or as the case may be, not later than Twelve o'clock noon on Wednesday, the 16th day of August instant.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
August 3rd, 1905.

COUNTY BOROUGH OF BLACKPOOL.
TO MAKERS OF GAUGING APPARATUS.

TENDERS are invited for the SUPPLY of an AUTOMATIC RECORDER and STARTING SWITCH in connection with Sewage Chambers and Pump.

Specification and drawings can be obtained from the undersigned, to whom Tenders, endorsed "Gauging Apparatus," must be delivered not later than 10 a.m. on Wednesday, August 16th.

JOHN S. BRODIE,
Borough Engineer and Surveyor.

Town Hall, Blackpool,
July 31st, 1905.

BOROUGH OF PEMBROKE.
PEMBROKE DOCK WATER.

TENDERS are invited for the SUPPLY of TWO SUCTION GAS PLANTS and for the necessary ALTERATIONS to the present ENGINES to make them suitable for use with producer gas.

The Council are also prepared to consider TENDERS for SUPPLYING NEW ENGINES and OFFERS for the EXISTING ONES.

A Plan of the Building can be seen at the Office of the Town Clerk at Pembroke Dock by appointment, and the Chairman of the Water Committee will be pleased to attend and give all information necessary.

Copies of the specification can be obtained on application to the undersigned, and sealed Tenders, endorsed "Tenders for Suction Gas Plant," must be received by him on or before 12 noon on August 19th.

The Council do not bind themselves to accept the lowest or any Tender.

R. D. LOWLESS,
Town Clerk.

Town Clerk's Office, Pembroke,
July 29th, 1905.

COUNTY BOROUGH OF SOUTHAMPTON.
TO ENGINEERS AND OTHERS.

The CORPORATION invite TENDERS for SUPPLYING and FIXING at the Corporation Wharf, Chapel, three 18-in. HIGH-PRESSURE DIRECT-ACTING CENTRIFUGAL PUMPING ENGINES, including all Suction and Delivery Pipes, Steam and other connections.

Particulars may be obtained upon application to Mr. J. A. CROWTHER, A.M.Inst.C.E., Borough Engineer, Market Chambers, 123, High Street, Southampton.

Sealed Tenders, endorsed "Tender for Pumping Engines," must be delivered at my office before 2 p.m. on Monday, the 4th September next.

No pledge is given to accept the lowest or any Tender.

By order,
R. R. LINTHORNE,
Town Clerk.

Town Clerk's Office, Municipal Offices, Southampton,
July 21st, 1905.

NORTHWICH RURAL DISTRICT COUNCIL.
BARNTON SEWERAGE and SEWAGE DISPOSAL WORKS.

The Rural District Council of Northwich are prepared to receive TENDERS for the CONSTRUCTION of SEPTIC TANKS, BACTERIAL FILTERS, STORM WATER FILTER, and Auxiliary Works, at Barnton, together with about 1,800 lineal yards of 12-in. and 9-in. Stoneware Sewers, with Manholes, Pump Well, Syphon Chambers, etc.

Plans can be seen and copies of specification and bill of quantities obtained from the Engineer, Mr. W. M. BECKETT, Assoc.M.Inst.C.E., 33, Brazennose Street, Manchester, on deposit of one guinea, which sum will be returned on receipt of a *bona fide* Tender and the return of all documents lent to the Contractor for the purpose of making up his Tender.

Sealed Tenders, endorsed "Barnton Sewerage," to be deposited with me by 12 o'clock noon on Thursday, August 24th, 1905.

J. ERNEST FLETCHER,
Clerk to the Rural District Council.

Northwich.

APPOINTMENTS OPEN.

APPOINTMENT OF COUNTY SURVEYOR.

DERBYSHIRE COUNTY COUNCIL.

The Council invites APPLICATION for the POST of COUNTY SURVEYOR at a salary of £500 per annum, rising by annual increments of £25 to £600. No pension.

The Surveyor shall devote the whole of his time to the duties of the office, and shall have the entire charge of all roads and bridges under the care and control of the County Council. He shall supervise and report on the work of the district surveyors and of the Local Authorities who have claimed to repair their main roads whether under contract or not. He shall attend all necessary meetings, and shall prepare such plans, estimates, and reports as may be required.

The Surveyor must have a thorough practical knowledge of the making and maintaining of roads, of the different materials employed, of the best methods of using steam rollers, and of the management of roadmen, and no testimonials will be considered unless the applicant can show he possesses these qualifications.

The Council will provide offices, clerical assistance, and stationery, and an ample allowance for travelling will be made, but this will be arranged with the Surveyor after his appointment.

The Surveyor must also carry out any further duties that the Council may require from time to time.

The appointment will be made subject to determination on three months' notice by either side.

Canvassing directly or indirectly will disqualify.

Particulars of duties, &c., can be obtained from, and all applications, accompanied by copies of three recent testimonials (originals will not be returned), must be sent on or before the 6th day of September, 1905, to the undersigned.

N. J. HUGHES-HALLETT,
Clerk of the County Council.

County Offices, Derby.

WATER OF LEITH PURIFICATION AND SEWERAGE COMMISSIONERS.
APPOINTMENT OF ENGINEER.

A duly qualified CIVIL ENGINEER is REQUIRED by the Commissioners to devote his whole time to the Superintendence of the Engineering Work involved in the management of their system, and the carrying out of their Acts of Parliament.

Salary, £200 per annum.

Applications will be received by the Commissioners' Clerk, H. INGLIS LINDSAY, W.S., 16, Queen Street, Edinburgh, up to and including the 21st day of August, 1905.

Each application must be accompanied by twelve copies of testimonials.

Further particulars may be obtained from the Clerk.

Edinburgh, August 4th, 1905.

THE GLASGOW AND WEST OF SCOTLAND TECHNICAL COLLEGE.

The Governors invite APPLICATIONS for the PROFESSORSHIP in the DEPARTMENT of ENGINEERING in this College, vacant by the appointment of Professor Watkinson to the Chair of Engineering in the University of Liverpool. Salary £500.

Applications, with testimonials, must be sent not later than August 21st, to the SECRETARY, Technical College, Glasgow, from whom further information may be obtained.

THE UNIVERSITY OF LIVERPOOL.
FACULTY OF ENGINEERING.

APPLICATIONS are invited for the following POSTS :—

ASSISTANT LECTURER in ENGINEERING, whose duties will be chiefly in connection with the subject of Surveying. Salary £200 per annum.

ASSISTANT LECTURER and DEMONSTRATOR in ENGINEERING. Salary, £100 per annum.

Applications to be sent to the Registrar (from whom further particulars may be obtained) not later than August 14th.

Duties to commence on October 2nd, 1905.

P. HEBBLETHWAITE,
Registrar.

THE WESTERN VALLEYS (MON.) SEWERAGE BOARD.
CONSTRUCTION OF MAIN TRUNK SEWER.
INSPECTORS OF WORKS REQUIRED.

The Western Valleys (Mon.) Sewerage Board propose to appoint several INSPECTORS at a salary of £2 10s. per week, to superintend under the engineers and resident engineer, the carrying out of their main sewerage works, and invite APPLICATIONS from persons who have had experience in similar works.

Applications, sealed and endorsed "Inspector of Works," must be on forms to be obtained from me, accompanied by not more than three recent testimonials, and must reach me not later than 10 a.m. on Monday, the 21st August, 1905.

Canvassing, either directly or indirectly, will disqualify.

T. S. EDWARDS,
Clerk to the Board

24, Stow Hill, Newport (Mon.),
July 29th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading specialities ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers, Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Fengl, A., & Co., Grafton Street, Altrincham.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Brown, Andrew, & Co., 110, Cannon Street, London, E.C.
Méguin, Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

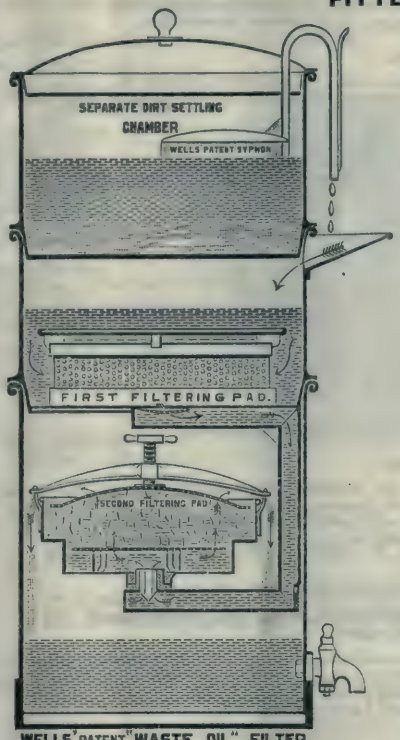
Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY — Wells' Specialities

WELLS' PATENT "Waste Oil" FILTERS

FITTED WITH SIGHT-FEED SYPHON.



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SUPPLIED TO THE PRINCIPAL GOVERNMENTS FOR THE NAVY, DOCKYARDS, &c., AND TO THE LEADING ELECTRIC LIGHT INSTALLATIONS, ENGINEERING WORKS, GAS ENGINE MAKERS, PRINTERS, &c., &c.

OVER *11,000* SOLD.

MONEY SAVERS to any USERS OF MACHINERY.

Pay first cost in a short time, as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again and again.

Write for List of Testimonials and Samples of Work done by the Filter.

No. 1.—For users having only a small quantity of oil to treat (no syphon) 17 in. by 9 in.	35/-
No. 2.—Two top chambers hold about 3 gallons oil, 22 in. by 10 in. ..	50/-
No. 3.—Two top chambers hold about 6 gallons oil, 27 in. by 12 in. ...	70/-
No. 4.—Two top chambers hold about 12 gallons oil, 36 in. by 16 in. ...	110/-
No. 5.—Two top chambers hold about 24 gallons oil, 43 in. by 23 in. ...	189/-
No. 6.—Very powerful Filter for treating large quantities of oil, 54 in. by 30 in.	336/-

Capable of dealing with **250** Galls. Oil per week

LARGER SIZES MADE TO ORDER.

NO OUTSIDE POWER REQUIRED.

LIME, WHITING, OR COLD WATER PAINTS,

Applied at a speed of from 8 to 10 square yards per minute, in a manner superior to brush work.

One coat with the Machine on rough surfaces is equal to two applied with brushes.

Will save First Cost in a Few Days.

No. 6A.	Small Size with Detachable Rail	£5 15s.
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No. 4A.	Price, with Wheels, 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose, **Same capacity as No. 4 Machine.**	£9 10s.
No. 5.	With 5-ft. Pole, Double Spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals.	£10 10s.
No. 5A.	Ditto Ditto fitted with Wheels.	£11 15s.

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MUCH SUPERIOR TO ORDINARY LIMEWASH. SLAKED WITH WATER. QUICKLY MIXED. WILL NOT RUB OFF. LEAVES A GOOD SURFACE.

Price 13/8 per cwt.,

Carriage Paid in England and Wales, (If in lots of 3 cwt. at a time, 12/8 per cwt.)

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Works: Cheetham, Manchester. **LONDON, N.W.**

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"LIGHTNING"

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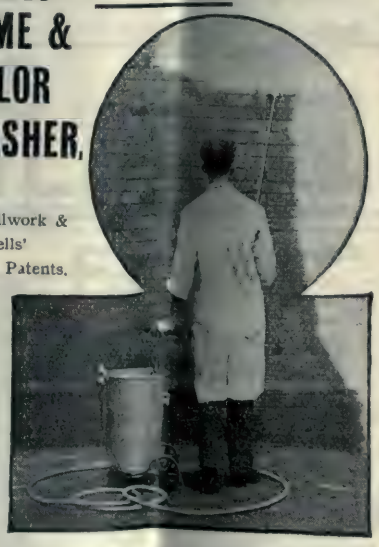


No. 4a, with Wheels.

Buyers' Directory—(*Continued*).

Photo Copying Frames.
J. Haldon & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.
Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Pinch Bars.
Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.
Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).
Greenwood & Batley, Albion Works, Leeds
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.
Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax

Rails.
Wm. Firth, Ltd. Leeds.

Railway Wagons.
Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.
F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.
Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.
D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).
Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.
Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).
Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).
Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.
British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.
Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.
Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.
Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.
S. Pegg & Son, Alexander Street, Leicester.

Superheaters.
A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.
Howard Bros., 40, Paradise Street, Liverpool, and 100c, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.
Warwick's Time Stamp Co., 134, Highbury Hill, London, N.

Tubes.
Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.
Elliott-Fisher Co., 75, Cannon Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.
Holmes & Co., W. C., Huddersfield.
Hunt & Mitton, Crown Brass Works, Oozells Street North, Birmingham.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.
Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.
Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Weighing Apparatus.
W. & T. Avery, Ltd., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.
A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W

Wind and Water Supply Machinery.
Eric S. A. Smith, Bridlington.

Wire Working Machinery.
Ed. Brand, 35, Shakespeare Street, Manchester.

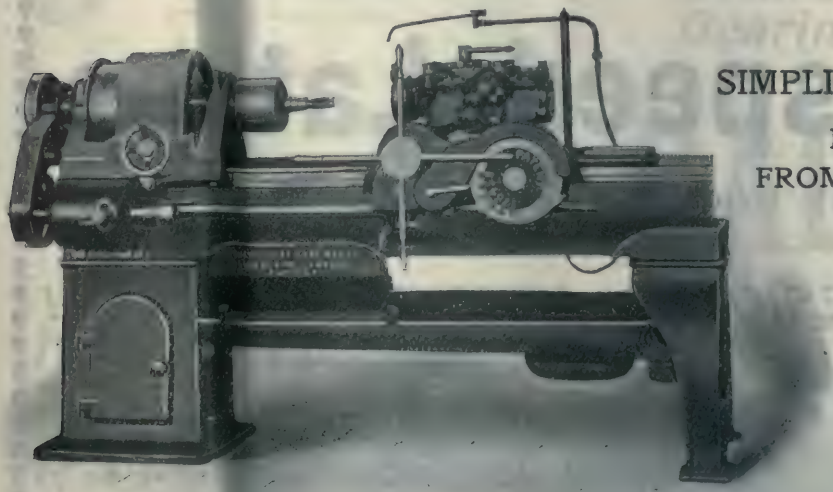
"Woodite."
"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY — Miscellaneous

PAGE'S WEEKLY **Miscellaneous**

PAGE'S WEEKLY Machine Tools, &c.

TURRET LATHE SPECIALISTS.



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SIMPLICITY of this LATHE
DIRECT DRIVEN
FROM THE MAIN SHAFT.

VARIABLE SPEED HEADSTOCK.

The RACK and GUIDE direct under the cutting tool being completely covered.

ALL HANDLES and STOPS within reach of the Operator.
THE ONLY CORRECT GRIP CLUTCH.

Telegrams: "CRITERION, LINWOOD."
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ECLIPSE TOOL MFG. CO., Linwood, nr. Glasgow.

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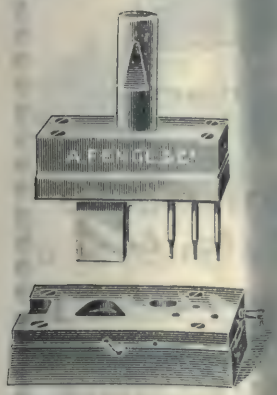

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If so, send your requirements, and

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ALTRINCHAM,
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See our half-page Advertisement alternate weeks.

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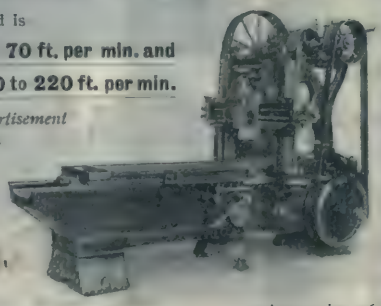
LEEDS.



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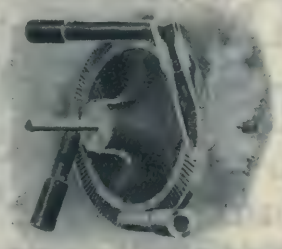

Machine Tools.

Dynamos & Motors.

De Laval's Patent Steam Turbines.

PAGE'S WEEKLY — Machine Tools

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290, Claremont Road, HALIFAX.

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FROM

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STROKE.

Above illustration is of my **8 in. STROKE MACHINE**, with Balanced Ram, Quick Return, and Canting Table. Shall be glad to submit full particulars of this or any other of my tools on application.

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PATENT FRICTION CLUTCH and SHAFT COUPLING.

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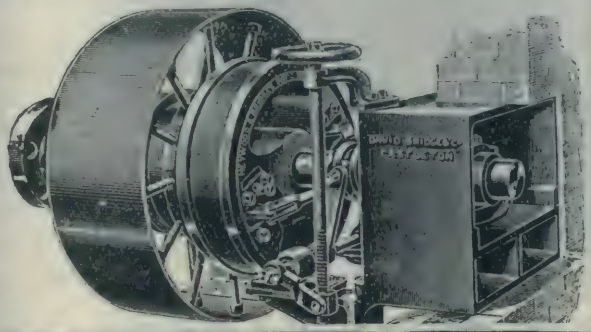


Patentees and Sole Makers:

DAVID BRIDGE & CO.

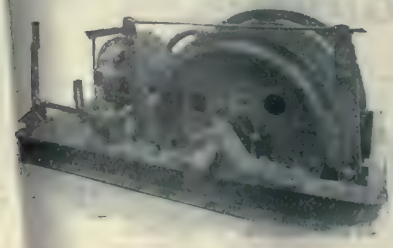
Castleton Iron Works,

ROCHDALE, LANCS.

London Office:

35, Queen Victoria Street, E.C.

Electric Hauling GEARS



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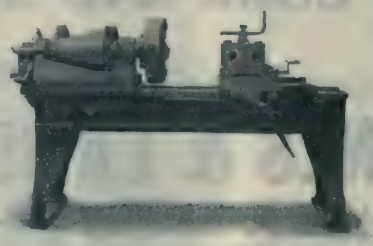

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PAGE'S WEEKLY

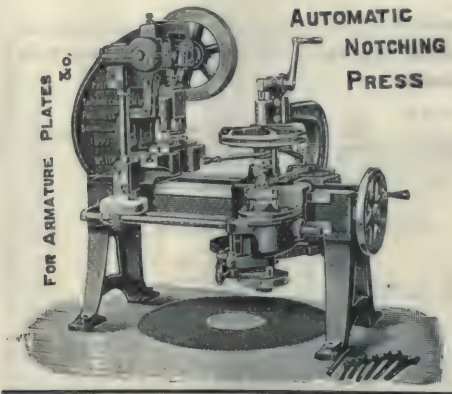
Miscellaneous

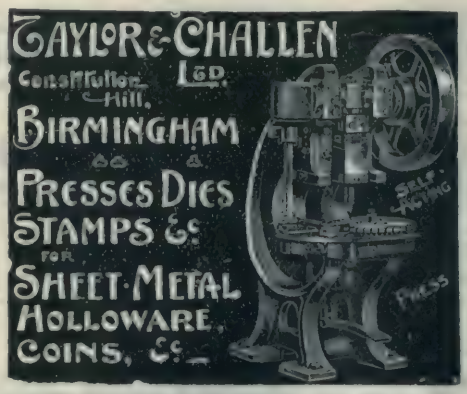
Index to Advertisers.

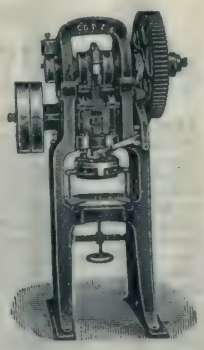
Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE'S WEEKLY

Miscellaneous







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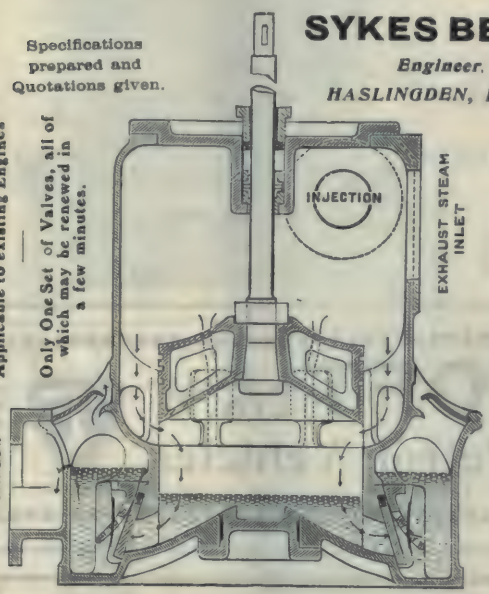

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PAGE'S WEEKLY

Miscellaneous

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VII. LONDON, FRIDAY, AUGUST 11, 1905. No. 48.

The Offices of "Page's Weekly," Wednesday Evening.

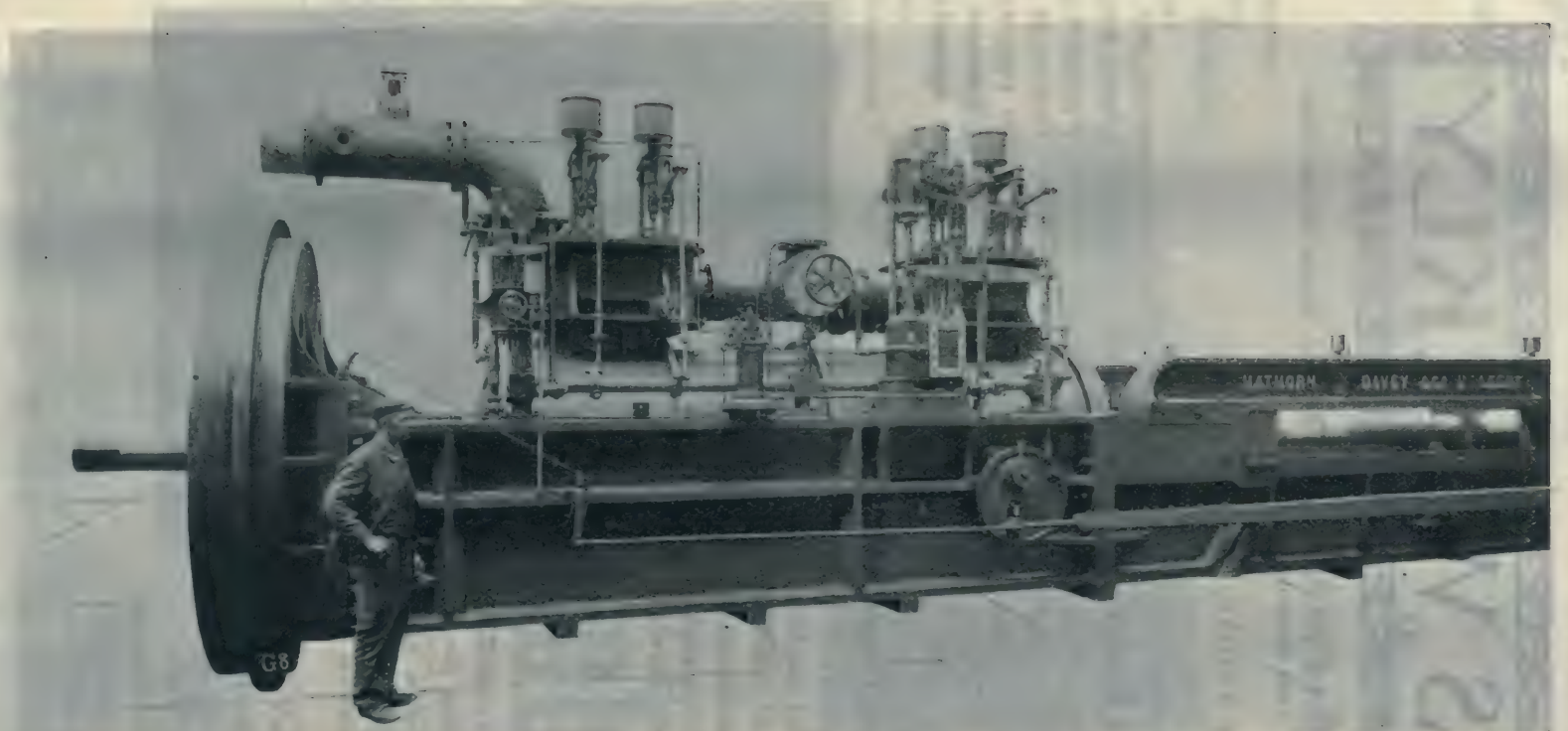
APROPOS of the visit of the French fleet we illustrate types of French warships on pages 299 and 301. The entertainment which began with the arrival of the French fleet in Cowes Roads on Monday last, following as it did so closely on the English visit to Brest has completely established the entente cordiale. Here politicians, engineers, and commercial men meet on common ground. France and England have important material interests all over the globe, and there ought to be no real obstacle to a real and permanent good understanding between the two nations. The trade between the two countries is in itself of sufficient volume to outweigh matters in which the interests of the two people may be supposed to clash. The visit of the French navy cannot help but cement an entente which has become something more than a mere phrase. The King has, it may be noted, conferred the G.C.M.G. upon the three French Admirals, and upon other officers, lesser grades of that order.

Although the British Foundrymen's Association, which held its annual Convention on Monday, Tuesday, and Wednesday last in Glasgow, is a comparatively new body, its advent in the arena of technical institutions may be warmly welcomed, as the President of the Convention, Mr. Robert Buchanan, made clear that the objects of the Association are of a purely scientific and technical character, and are calculated to prove of practical value to the industries from which its members are drawn. The papers submitted to the Convention, as will be seen from the report in another part of this issue, were of an eminently practical character, and some attention will be devoted to them in future issues.

Elliott & Fry.

FREDERICK SHELFORD, B.SC., M.INST.C.E.,

Who acted as consulting engineer to the recently completed Sierra Leone Railway. (*See page* 303).



PUMPING PLANT AT TASMANIAN GOLD MINE.

The above illustration shows engine without low-pressure cylinder forming part of the large pumping plant supplied by Hathorn, Davey and Co., Ltd., to the Tasmanian Gold Mine, a contract secured by them in open competition with foreign firms. Tenders were invited for a pumping plant capable of dealing with from 7,000,000 to 8,000,000 gallons per day from a depth of 2,000ft. The plant is divided into three units. Each unit when fully completed will consist of a steam engine placed upon the surface, actuating four pairs of plunger pumps fixed in the shaft, raising the water 2,000 ft. in four stages, each of 500 ft. The engines are compound, differential condensing engines of Messrs. Hathorn, Davey and Co.'s well-known type, but of unusually large size, and built for a steam pressure of 150 lb. Each engine has a low-pressure cylinder 108 in. in diameter, with a stroke of 10 ft., and a high-pressure cylinder 50 in. in diameter, also with a stroke of 10 ft. The valves for the admission and exhaust of the steam are of the balanced Cornish type, and are actuated by Davey's well known differential gear. In addition to this a pumping gear is provided. The pumpwork proper is of an exceedingly massive character.

Some interesting particulars dealing with the Suez Canal are contained in a report by Mr. Consul Cameron which has just been issued. The present navigable dimension of the canal are double what they were twenty years ago. The original depth of the channel was 26 ft. 3 in., and its bottom width 72 ft. The work of deepening the channel is steadily proceeding with the intention of arriving at a uniform depth of 31 ft., and from kilometre 61 near El-Ferdan as far as Suez the bottom width is to be increased to 128 ft. The curves are also being improved, and a large crossing-place is being constructed in the small Bitter Lake. Taking the canal as a whole, it may be said that its width on the water level in the northern half is from 100 to 120 yards, and in the southern half from 80 to 100 yards. Lastly, the widening of the channel at Port Tewfik will enable battleships and large cruisers to coal rapidly alongside the buoys, instead of having to coal slowly in the roads.

As illustrating the wear of high speed engine bearings, an American contemporary gives particulars of a high speed engine supplied for the electric plant at Digby, Nova Scotia, in June, 1892, which ran an average of ten to twelve hours each night over a period of thirteen years. The engine is of the high-speed centre crank type, with cylinders 10½ in. diameter, and stroke 12 in., speed 275 revolutions per minute. The main bearings of the crank shaft run in solid sleeves or cells lined with babbitt. The journals, of forged steel 3⅞ in. diameter and 12 in. length were ground and lapped, the shell being two-thousandths of an inch larger than the shaft journal to allow for oil. The journals were oiled continually by ring oiling in oil cups to keep up the supply. The shaft journals, which have not had anything done to them since the engine was started, were in good condition, and show a wear of only one-thousandth of an inch.

The shells or sleeves were replaced six and a half years ago, and during that time show wear of only six-thousandths of an inch. The crank-pin for thirteen years' running, was reduced only seven-thousandths of an inch at the centre and five thousandths at the ends. The steam valve, which is of the flat balanced type, was reduced only three-thousandths in thickness by wear, and, when scraped perfectly parallel and true, was only five-thousandths under the original size.

The North-Eastern Railway Company are about to undertake an investigation in regard to the relative efficiency of the simple and compound types of locomotives. Mr. Wilson Worsdell, the Company's chief mechanical engineer, has just designed and put into construction, two experimental four-cylinder compound locomotives which are said to be of a larger and heavier type than any previously built for service in this country, exceeding in dimensions the now familiar Atlantic type of simple locomotives which are employed for heavy express passenger traffic. The Great Central are also building an Atlantic engine of the three-cylinder compound type, while the Great Northern Company is just putting into service a four-cylinder balance compound engine built for them by the Vulcan Foundry, which is to work heavy passenger trains running out of London.

The opening of the great Langsett reservoir on Monday last witnessed the completion of an engineering scheme which the Sheffield Corporation has been engaged upon for some years. The new reservoir has an area of 120 acres, and a capacity of 1,400,000,000 gallons. The dam is 1,200 ft. long, with a bottom width of 700 ft., and a top width of 36 ft. The total yield of the watershed is about 11¼ million gallons per day, of which 4½ million gallons are compensation water.

Some engineers think the size of hoisting ropes generally used in mines is unnecessarily large, and that smaller ropes would answer as well. For instance, it is claimed that a rope of ¾ in. diameter has a breaking strain of 50,000 lb., while a rope of 1 in. diameter, costing 70 per cent. more, has a breaking strain of 88,000 lb., and that under ordinary conditions the weight raised in mine skips, etc., not over 1,500 ft. in depth, does not usually exceed five tons, including rope, skip, and load, which is a factor of 5 for safety. The smaller rope, moreover, admits the employment of smaller sheaves and drums, being 3½ ft. diameter for the ¾-in. rope and 4½ ft. for the inch rope. The argument is not unreasonable, but the factor for safety should never be lower than 5, and a higher factor is preferable. It is not the usual practice, however, to raise 5-ton loads with ¾-in. ropes. Ordinarily, the skips do not weigh above one ton with a load of two tons, and in such cases the ¾-in. rope is heavy enough for the work.

Another aspect of this question, the transmission of power by ropes, is discussed by the Mining and Scientific Press, and the points raised merit consideration, although some of them will be familiar to many readers. Where manila rope is used in transmitting power the grooves must be carefully turned so as to fit the rope. When the groove has too small an angle for the size of rope employed, the rope is forced down into the groove, creating unnecessary friction. In practice it has been found that a groove having a 45 deg angle is satisfactory. The rope should not touch the bottom of the groove, and the size of the groove should be such that the centre of the rope is somewhat above the lines of contact of the rope with the sides. The angle of the groove remains constant, no matter what the diameter of the rope, though the flat space at the bottom of the groove will vary in width with the diameter of the rope.

The grooves vary in depth as they do in width. A groove suitable to run a 1-inch rope is ½ in. wide just above the bottom, and one suited to a 2-inch rope is 1 inch wide just above the bottom space. Grooves should not only be turned smooth, but should be polished as well to lessen the friction, and also to obviate any tendency on the part of the rough sides of the groove to cut the rope. The inequalities left by the turning tool, though small, are nevertheless sharp, and quickly cut a manila rope, fibre by fibre, until the rope is destroyed. Any imperfection in the wheel casting, such as sand or blow holes, will injure a rope seriously in a short time and should be looked after, and filled with iron cement, if present. Where tail ropes are used in hoisting, the tail rope is of the same size and weight for given length as the hoisting rope. It permits a constant weight of load at the winding drum.

Engineers are aware that thorium is the chief light-producing element in the incandescent mantle, and some apprehensions have been felt by those engaged in the gas industry as to a prospective shortage of this rare earth. The South Metropolitan Gas Company has taken steps to obviate any inconvenience as affecting its own operations which might arise from such a state of affairs, by the purchase of a monazite property in North Carolina, monazite sand, it is almost needless to add, being a main source of thorium. Manufacturers, when first hearing the news of this purchase, were under the impression that the South Metropolitan Gas Company was intending to manufacture mantles; but at the meeting of the Company on Wednesday Sir George Livesey stated that such was not to be the policy of the company, which had made the purchase with the view of steadying prices, and preventing an undue rise in the price of thorium. Sir George, moreover, illustrated his address with an experiment in the manufacture of incandescent gas mantles, and gave to the proceedings something of the appearance of a Royal Institution lecture.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No: 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Editorial.—*All communications intended for publication should be written on one side of the paper only, and addressed to "The Editor."*

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

NEWS ITEMS.

New York advices state that the pig-iron market remains quiet, but there is a firm undertone and good business is predicted for the immediate future. Steel continues to be in strong demand, the business in structural material being exceptionally heavy.

The Home Secretary announces in the London Gazette that he has made an order, under Section 6 of the Coal Mines Regulation Act, 1896, entitled "The Explosives in Coal Mines Order of the 4th August, 1905," the effect of which is to add three explosives, Kynite condensed, Rexite, and Withnell powder to the list of permitted exposives.

The total quantity of iron and steel manufactures exported from the United Kingdom last month was 362,810 tons, an increase of 109,693 tons over the quantity shipped in July of last year; and the total for the last seven months was 2,101,976, an increase of 213,802 tons. The value of shipments of this description last month was £2,877,198, and that for the seven months £17,843,803, as compared with last year's totals of £2,185,654 and £16,154,705 respectively.

The Administrative County of London Electric Power Bill cannot be placed on the Statute Book this session, as time at the disposal of Parliament is too short, but an effort is being made to obtain sanction in the House of Commons to "the hanging up" of the measure so that its consideration can be resumed next year at the stage where it is now dropped. At the time of writing no decision has been arrived at.

CONTENTS.

Patent Point Controller.

In fig. 1 is illustrated Parr's Patent Point Controller. This controller is operated electrically, and is claimed to be applicable to any existing system of points, and for all systems of electric traction, whether on trolley, conduit, or surface contact systems. It operates both the points and the overhead frogs at the same time, and does not call for any special equipment to the car, or alteration of any description of the current connecting device, or wiring. It can be so arranged that the points, unless operated, are set for one line, or each car can move the points for itself. All that is required is for the motorman to have the ordinary motor controller on any notch to operate the points, and off altogether if the points are not to be operated. The lamp current of the car cannot actuate the point controller, which can also be set so that the driver cannot operate and take his points above a certain prearranged speed. The controller is stated to be unaffected in its action by a variation of 150 volts and 550 volts, and to produce no spark or bump as the trolley wheel of the car runs under the contact on the overhead wire.

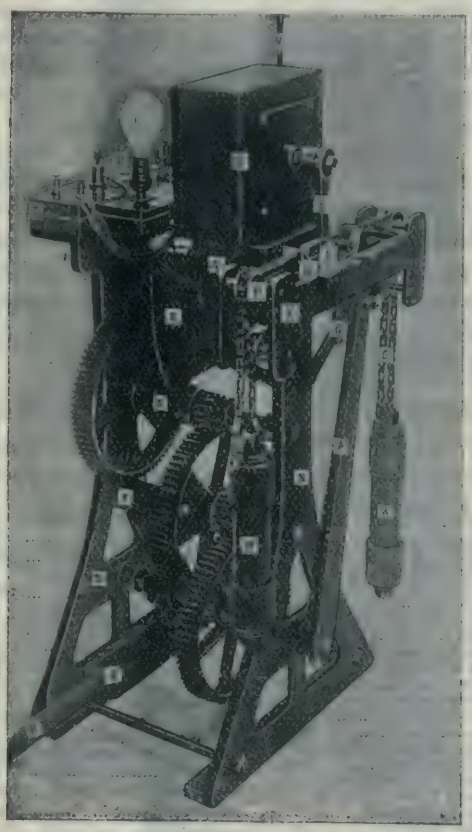


FIG. 1. PARR'S PATENT AUTOMATIC ELECTRICAL POINT CONTROLLER.

The first controller of this design was installed at one of the busiest junctions on the Leeds City Tramways, where the minimum service is ninety cars per hour, rising to one hundred and ten cars per hour at busy times. This severe test, extending over a period of six months is stated to have shown that the controller is efficient and reliable.

The controller does away with the necessity for pointsmen; it secures the simultaneous working of the track points and overhead frog, so that the motorman has these absolutely under his direct control without stopping his car or quitting it, and can take either of two routes. Hadfield's Patent Steel Foundry Company, Ltd., are the sole makers of this patent controller.

London's Waterworks.

The Works and Stores Committee of the Metropolitan Water Board has made a report as to the expenditure on new works, a large portion of which, it is explained, was arranged for before the Board acquired effective control. In all, the estimated expenditure is £514,066, of which £200,306 is expected to be necessary during the year 1905–6. One of the chief improvements is the provision of new filter beds for the southern district. Twelve acres of new filter-beds are estimated to be required, for six of which land is in hand at Hampton, and the work can be commenced immediately. Another large undertaking is the provision of a reservoir at Honor Oak, to hold 52,000,000 gallons of water, which is estimated to cost £160,000. Pumping machinery and buildings at Walton will involve the expenditure of a further £75,000.

Iron Company Results.

The Normanby Iron Works Company has a gloomy record to tell of, and the report just published in respect of the past year can hardly be regarded as encouraging. The profit attained £7,861, as compared with £8,224, and after meeting debenture interest, etc., there is an available balance of £7,876. This does not permit of any distribution on either the preference or ordinary shares. Since its inception in 1900, the concern has only once paid any dividend, and that was during the first year, when the vendors contributed a large sum to the revenue account.

Electricity in Mines.

Attention is drawn in the report of H.M. Inspector of Mines for North Wales to the electric developments in the slate mines of Merionethshire. At Llechwedd slate mine the Marvin-Sandycroft electric drill is giving

great satisfaction. At Bwlch-y-slater mine a small electric plant has been erected for winding and lighting. At Maenofferen slate mine a plant has been installed for driving the slate mills, and for haulage, pumping, and lighting. Lastly, at the Croesor slate mine, a plant of noteworthy character has been erected. The waterfall supplying the power is probably the greatest that has yet been utilised in Great Britain.

An Important Installation.

This plant is the first application of the three-phase system to slate mining, and includes the first electric locomotive used in slate mining. The reservoir is 860 ft. above the power-house, and the water is conveyed through 3,200 ft. of 12 in. steel pipe to two impulse wheels of 375 and 25 b.h.p. respectively. The larger wheel is direct coupled to a 250 kilowatt three-phase generator wound for 2,750 volts, and the smaller wheel is direct-coupled to two direct-current generators that can be used alternatively as exciters or for lighting. Power is transmitted to the mine by overhead lines, 3,200 ft. long, the loss in transmission being about 2 per cent. The high voltage is transformed to 220 volts, and electricity is supplied for hauling from the lower galleries 4½ tons in twenty seconds, for pumping 20,000 gallons of water an hour, for electric winches, for arc-lamps, for an electric locomotive hauling a train of 30 tons at a speed of four or eight miles an hour, and for driving twenty-four sawing tables and twenty-four dressing machines in the slate mill.

Output of German Pig Iron.

The returns issued by the Statistical Department of the German Association of Iron and Steel Masters show that the output of pig iron in the German Empire (including Luxemburg) during June amounted to 918,174 tons, against 951,431 tons in the previous month, 836,785 tons in June, 1904, and 839,541 tons in June, 1903. This shows a decrease compared with the previous month of 33,257 tons, or 3·5 per cent, but compared with the same month last year, there is an increase of 81,389 tons, or 9·73 per cent.

Wood-Working Machinery.

On this page is shown Messrs. Kirchner's Extra Heavy Panel Planing, Thicknessing, and Moulding Machine, with two side cutterheads to work one, two, and three sides of the timber at one operation. This is illustrated in fig. 2. The machine is built 16 in., 20 in., 24 in., and 28 in. wide, and is indispensable for manufacturing sash and door work, for floor boards, for matchboarding, etc., at one single operation at high rates of speed. If desired a fourth cutterblock is fitted to the machine so that the four sides of the timber can be worked at one time.

In fig. 3 is illustrated one of Kirchner's Combined Hand and Power-feed Planing, Thicknessing and Moulding Machines, which is built 14 in., 20 in., 24 in., and 28 in. wide, and is suitable for users who have not sufficient space available to put down two separate machines.

Copper Statistics.

The rise that has taken place in the quotation for copper of late lends more than ordinary interest to the monthly returns. As compared with the previous return, the stocks at 12,341 tons show a slight increase of 81 tons, but this is more than set off by a decrease of 294 tons in the visible supplies owing to the decrease in the shipments advised from Chili and Australia. For the whole month of July the total supplies amounted to 24,980 tons, which is over 1,500 tons less than the shipments for June, while the

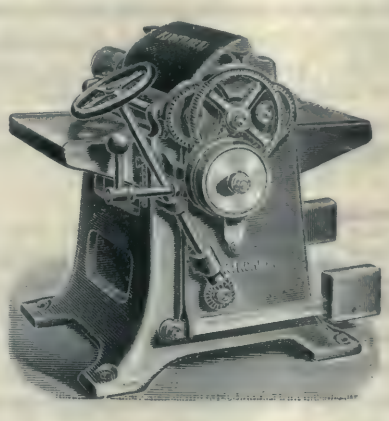


FIG. 2. EXTRA HEAVY PANEL PLANING AND THICKNESSING MACHINE.

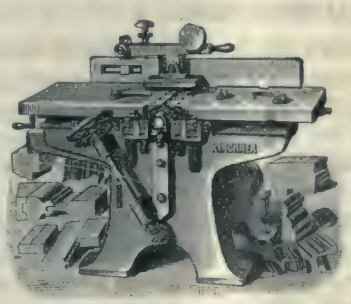


FIG. 3. COMBINED HAND AND POWER-FEED PLANING, THICKNESSING AND MOULDING MACHINE.

deliveries have exceeded the supplies by nearly 600 tons.

The chief falling off has been in the American shipments, which dropped to 15,385 tons, as against the large total of 19,058 tons recorded for June. The Australian shipments also declined, but those from Spain and other countries showed a considerable increase. The price of the metal has responded pretty closely to the movements of statistics, having risen from £65 15s. per ton at the end of June to £66 5s. per ton on July 15th, and to £68 5s. per ton on the 31st of that month. It may be mentioned that, as compared with a year ago, the price on the 31st ultimo showed an advance of no less than £11 per ton, and this notwithstanding the fact that the visible supplies were nearly 4,600 tons greater than at the same date last year.

Russian Electrical Trade.

The employment of electricity, reported by the Board of Trade Journal, is rapidly increasing in Russia, and Germany still seems to have quite a lion's share of the market, both as regards getting the big contracts for electrifying railways, etc., and for supplying all sorts of plant. The installation of electric lighting in towns, the conversion of tramway systems to electric traction, etc., is taking place in various towns, but everywhere it is being done by Germans.

Road Locomotion.

The Royal Commission on motor-cars will consist of Viscount Selby (chairman), the Marquess of Winchester, Sir W. Forwood, Mr. Mure, Mr. Henry (Chief Commissioner of Police), and representatives of the Local Government Board and of Ireland. The terms of reference are wide, and embrace not only the working of the new Act, but the whole question of road locomotion.

Commercial Motor Vans.

Comparatively few entries have so far been received for the light delivery van trials, which will be held by the Automobile Club from September 21st to October 25th. The list does not close, however, until August 23rd, and in view of the enormous opening before the commercial motor, it is to be hoped that the numbers will be doubled or trebled by that date. In Class A, designed to carry 5 cwt., an Alldays, Simms, Welbeck, and a London and Parisian are entered. Class B, for vehicles to carry more than 5 cwt. but not exceeding 10 cwt., Wolseley, Alldays, De Dion Bouton. Class C, exceeding 10 cwt. but not exceeding 1 ton, James and Browne, Wolseley, Milnes Daimler, Dennis, Simms Welbeck, Thames Ironworks, and a light steam lorry by the Bickford Burners Company. Class D, exceeding one ton but not exceeding 1½ tons, Milnes Daimler, De Dion Bouton lorry, Dacre Motor lorry, and a vehicle entered by the Motor Car Emporium, Ltd. The trials will comprise thirty days' service of each delivery van, and a daily examination by the judges, the length of the daily run varying according to the class of vehicle. There will be four centres, namely Oxford, Kidderminster, Leicester, and Cambridge, and the conditions of the trial will approximate as closely as possible to those of actual services.

Post Office Telephones.

In the annual report of the Postmaster-General issued on Wednesday, it is stated that the number of trunk wire centres open on March 31st last was 443, an increase of 47 in the year. The new trunk circuits provided during the year numbered 186, and the total number in use was 1,604, as compared with 1,418 in the preceding year. The total length of the trunk circuits in use was 56,400 miles, containing about 112,800 miles of wire. The capital expenditure on the purchase and development of the trunk wire system up to March 31st last was £2,537,288, including an expenditure during the year of £337,264. The total number of conversations over the trunk wires for the year was 15,461,822. This shows an increase of 1,993,847, at the rate of 14·8 per cent. over the corresponding number for the previous year, which was 13,467,975. The gross revenue derived from this service was £380,308, as compared with £325,525 in 1903-4. The increase was thus at the rate of 16·8 per cent. The average value of each conversation was 5·9d.

A Club for Business Men.

The Mercantile Club has now secured permanent premises. The club-house is situated at 32, Dover Street, Piccadilly, and an exceptionally fine site adjoining and running through to 18, Berkeley Street has been secured, upon which specially designed premises will be erected at a cost of over £10,000.

Institution of Mining and Metallurgy.

The following new members have been admitted to the Institution of Mining and Metallurgy since May 11th, 1905: R. Hay Anderson, Mexico; J. Parke Channing, New York; Charles P. Durell, Colorado; Frank Klepetko, New York; James W. Malcolmson, Texas; J. Othon Mayen, Paris; B. Stanley Revett, Colorado; Edwin M. Rogers, New York; Edmund J. Spilsbury, New York; Thomas Trevaillé-Williams, Cornwall.

NAVAL NOTES.

Captain Bacon's pronouncement on the salvage of submarines has not been allowed to pass without protest. In his lecture before the Institution of Naval Architects Captain Bacon said that it was evident that consideration of rapid salvage was totally out of the question should foundering occur to the A class of boats in the majority of waters in which they worked. He pointed out that whatever appliances were available wind, sea, and tide would always be the determining factor as regards rapidity of work. It was as to whether the Admiralty should keep its own salvage plant that one or two critics joined issue with Captain Bacon. The latter thinks the Admiralty should attempt nothing of the sort, as the mere plant is a secondary consideration and practical experience of such work the main thing. However, it would appear that those whose opinion is likely to carry most weight agree generally with the conclusions arrived at by Captain Bacon, who if he is taking a mistaken view at least was in good company.

Reference was made in the last issue of Page's Weekly to the new plans of the Admiralty in relation to Rosyth and Chatham, but as a writer in the Glasgow Herald correctly points out this has greater reference to the design of warships than to questions of strategy pure and simple. The conditions at Chatham might have been modified to suit the dimensions of ships, if these were in the future to advance as in the past. The trend, however, demands such a large step that it has been found almost impossible within financial limits to improve the graving dock accommodation at Chatham to suit the probable proportions of the ships of the immediate future. In fact, it will in the future be more and more difficult even for the expert to recognise the difference between the battleship and the new cruiser, since the latter will be more powerful than any of the battleships built prior to the *King Edward VII.* They may excel even these in gun power.

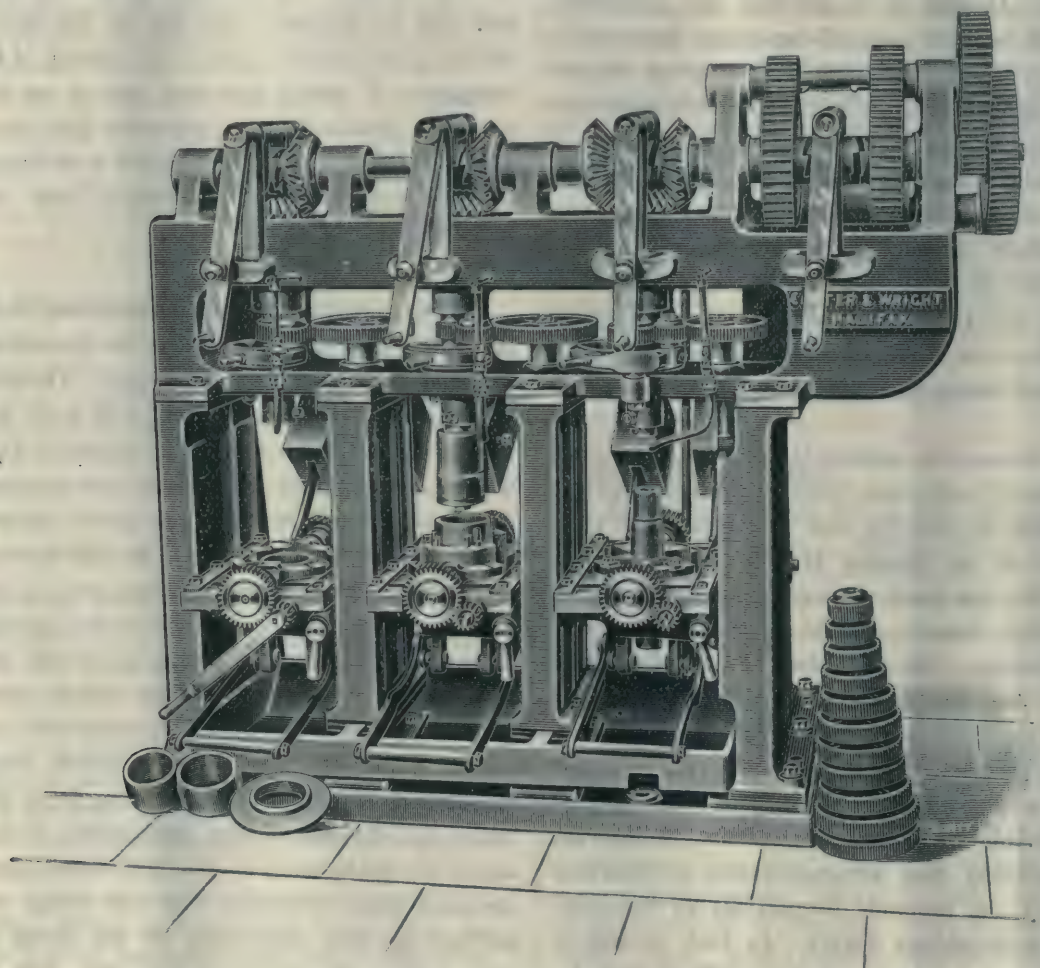
According to the Petit Var the launch of the French armoured cruiser *Jules Michelet* will take place at Lorient on August 31st. She was put upon the stocks last year, and at the time of the launch 55 per cent. of her construction will be finished. She will be the largest cruiser in the French navy. The launch of the submarine Y, which had been put off on two previous occasions, took place on July 24th. With a displacement of 213 tons she is the largest of French submarines, as distinct from submersibles.

The new battleship *Dreadnought*, now being laid down at Portsmouth, is to be the subject of a new departure in stern design. The ship, which is to be turbine-driven, will have four shafts, and although above the water-line there will be no apparent divergence from ordinary design, there will be two stern ports and two rudders under the water-line. By this arrangement there will be a rudder abaft each of the inner propellers, which will facilitate manœuvring operations, manœuvring being, of course, one of the difficulties with turbine driven ships. The Admiralty test of 18 knots astern with the rudder hard over constitutes a severe stress on the threaded shaft of the steering gear, and hence the division of the stern ports, a step which is frankly more or less of an experiment, although those responsible for the design are fortified in their conviction by the result of tank tests. The trials of the ship will be

awaited with the keenest interest in naval engineering circles.

There are one or two points of interest in connection with the official trials of the *Adventure*, the first of the new pair of scouts built by Sir W. G. Armstrong, Whitworth and Co. In addition to the two Armstrong scouts two each of the same class were ordered from three other firms, but the *Adventure* and its fellow ship differ in some respects from the other six vessels, chiefly in engineering details. One feature in the engines is the fact that they have six cylinders to each set, three of which are thrown out of action at cruising speed, and another is the fitting of the engines with an isolation valve which automatically shuts off steam in the event of fracture.

The vessel's dimensions are: Length, 374 ft.; beam, 38 ft. 3 in.; depth moulded, 23 ft. 3in.; draught, 12ft. 6 in.; and displacement, 2,620 tons. The engines are of 16,000 h.p., at 250 revolutions per minute, giving a piston speed of 1,062½ ft. per minute. The maximum number of revolutions on trial was 260·5 by the port engines, giving a piston speed of 1,107 ft. per minute. There are twelve boilers of the latest Yarrow type. The bunker capacity is 450 tons, which, will give the *Adventure* a radius of action of 4,500 miles at 10 knots.



THREE SPINDLE TAPPING MACHINE, BY MESSRS. CARTER AND WRIGHT, HALIFAX

THREE-SPINDLE TAPPING MACHINE.

This machine, which is illustrated on the opposite page, has been specially designed by Messrs. Carter and Wright for the tapping of large flanges and sockets up to 6 in. diameter, and also for tapping right and left hand threads in jigging screw nuts. It is of massive construction, the two end standards which support the machine being of box section, and upper and lower tanks are provided for the lubricant with rotary pump and necessary pipe connections. The lower tank is bolted to the foundation plate and forms support to the intervening vertical guides in which the tables move. The machine is driven from a countershaft by belt to a 3 speed cone with largest diameter of speed of 22 in. by 5 in.

This cone is mounted at back of the machine, and drives the machine cut spur gear, which has a purchase of 36 to 1 and 34 to 1 respectively. The change of gears can be affected whilst the machine is in motion by means of claw clutch and lever in front of machine. The spindles are 3 in. diameter, and mounted in beam of box section which forms the upper tank for the lubricant. Each spindle is driven by mitre wheels and can be stopped and started independently, by clutch and lever. The tables carrying the objects to be tapped are each provided with self centring double purchase two jaw chucks and are counterbalanced with adjustable weights; the tables are also provided with a support to prevent the tap from dropping and also to enable the operator to readily lift the tap into position after screwing a socket or flange.

Hand rails at each table enable the operator to assist the tap to bite when starting the tap without the gearing or for lifting the heavy taps into position. Machine cut gearing provided to each spindle, with necessary change wheels for different pitches of threads is connected to the table by square thread leading screws running down the insides of the standards and can be engaged or disengaged by handle and gun metal clam nut so that tapping can be done with or without gearing. The chucks for holding the sockets are provided with slip jaws, so that varying diameter and shape of jaws can be used. The weight of the machine is 145 cwt.

THE INCH AND THE METRE.

The Decimal Association, represented by its vice-presidents, Lord Belhaven and Stenton, and Lord Kelvin, is in arms against a proposal emanating from Mr. Thos. Parker, to which publicity is given in the Pall Mall Gazette. It is that a decimal system of weights and measures should be founded on the British inch, of which the British Weights and Measures Association are alleged to have made a fetish. It is pointed out that while there is no difficulty in dividing the inch into tenths, hundredths, and thousandths, as engineers already do, the attempt to deal with the rising scale in a similar manner brings the reformer who proceeds on these lines face to face with many difficulties.

And when it was all done, little would have been effected but the glorification of the British inch, and for that we should have upset all our old measures, except the inch, and would still be using a totally different system from that in general use on the Continent of Europe.

Lord Kelvin insists that the idea of co-relation of measures, weights, and capacities, if based upon the British inch, must be given up. But co-relation is not the only advantage claimed for the metric system. One of the greatest advantages, it is pointed out, is the fact that the largest portion of our foreign trade is with countries where the metric system is in force, and that its adoption would greatly improve our trade, while effecting great economies in the clerical labour connected therewith.

ELECTRIC DRIVING OF STAMP BATTERIES.

By L. WILMS.

THE main feature in the driving of stamp mills by electricity is not so much the question of the applicability of electric motors for this purpose as the proposition of generating cheap power in bulk by means of a large central electric station in place of the various engine rooms and boiler houses scattered over a group of mines under the control of one parent company. That the displacement of small isolated steam plants by electric motor installations of up to 100 b.h.p. makes for economy is generally understood, but that the further centralisation of power supply for larger motor units has a similar effect is a proposition which has only been recently advocated.

That the production of power in bulk and distribution of same by means of electricity is the cheapest method of power supply is due to the facts that the cooling surfaces of steam engines and pipes do not increase in the same ratio as the contents of the cylinders etc., do when compared with the output; that the expenses of attendance, lubrication and supervision are reduced; and that it is not necessary to double the engine units when making provision for spare plant in a central power station.

The larger the units, the less the steam consumption. The following will give a rough idea of the reduction of steam consumption, due to increase of size—

500-kilowatt Belliss engine at 150-170 lb. pressure, 150 deg. superheat, 13 lb. per b.h.p. hour; 1,500 kilowatt Belliss engine at 150–170 lb. pressure, 150 deg. superheat, 12 lb. per b.h.p. hour; 1,500 kilowatt Parsons turbine at 128 lb. pressure, 125 deg. superheat, 11¾ lb. per b.h.p. hour; 2,000 kilowatt Curtis turbine at 160 lb. pressure, 242 deg. superheat, 10¼ lb. per b.h.p. hour; 2,600-kilowatt Parsons turbine at 152 lb. pressure, 225 deg. superheat, 10¼ lb. per b.h.p. hour.

These steam consumption results were taken when exhausting into the condenser at 90 per cent. vacuum, only the result with the Curtis turbine being obtained at a vacuum of 95 per cent. of barometer. The recently installed 5,000-kilowatt Curtis turbines are expected to bring the steam consumption down to 9 lb. per b.h.p. hour. There is, however, no definite information available on the efficiency of these large machines. In central station practice only one driver per shift would be required for every 5,000 kilowatts, whereas at least six drivers would be necessary with split-up steam plants. The white labour in the boiler houses would also be reduced in a similar proportion, only the number of stoking boys remaining unaltered. There is also a saving in the cleaning and oiling requirements, due to smaller floor space and larger engine units in the case of the central station.

The extra expenditure in generators, cables and motors is about covered by the saving in cost of plant per horse-power of the larger engines, further by the reduction of total cost of buildings and by having to make less provision for spare plant.

CENTRAL STATION ECONOMY.

Two mills of 220 stamps each would be the minimum number to receive any benefit by being driven electrically. In a one-mill propostion it would be more economical to instal the electric generating plant for the rest of the mine power supply under the same roof with the mill engine.

Assuming two 400 h.p. motors to be installed in each mill and coupled direct to the main battery countershafting. the electrical efficiencies would be: Generators 94 per cent., cables 98 per cent., and motors 91 per cent. = 83·7 per cent. total efficiency. This loss of 16·3 per cent. is compensated by the lower steam consumption per b.h.p. in the central station. The steam consumption of direct-coupled 800 h.p. mill engines on these fields would be about 14 to 16 lb. per i.h.p. hour when supplied with dry steam and exhausting into the condenser. The mechanical efficiency $\frac{\text{b.h.p.}}{\text{i.h.p.}}$ of slow-speed horizontal engines is not above 87½ per cent., giving a steam consumption of 16–18 lb. per b.h.p. hour at engine shaft. High-speed vertical 1,000 kilowatt sets working under similar conditions, but with about 100 deg. superheat, require 12·5 lb. of steam per b.h.p. hour, or, allowing for above-mentioned electrical distribution losses, $\frac{12{\cdot}5}{0{\cdot}833} = 15$ lb. per b.h.p. hour at battery shaft. Eliminating the gain by superheating, the central station would still be able to supply power at the battery shafts with the same steam consumption per stamp and hour as the mill engine. If larger engine or turbine sets of 3,000 kilowatts (and above) are installed, there will be a decidcd reduction of steam consumption per b.h.p. at mill shaft as compared with ordinary mill engine practice.

Another point in favour of central station supply is the fact that the addition of the various loads, even if of a varying nature, allows each part of the plant to be run at its most economical load, whereas isolated steam plants may at times have to run under

uneconomical conditions of load, there being no facility for adjusting the loads to suit the engines. To show the saving effected by driving two 220-stamp batteries with electric motors I shall give some figures on the cost of power production. A for a 2,000 kilowatt central station with a maximum output of 1,030 kilowatts for power supply purposes outside of driving of stamp batteries; B for a 3,000 kilowatt central station with a maximum output of 2,140 kilowatts and supplying current to all motors on the property, including battery motors for two mills; C for the supply of current to mill motors only; D for supply of current for all purposes, including mill motors from central stations of various sizes, viz., 5,000, 3,000 and 2,000 kilowatts; E for supply of power from two separate mill engines.

The cost of total power supply from the central station only, as under B or D, should be lower than the sum of costs of power production under A and E in a smaller central station and two separate mill engines.

A.—COST PER UNIT IN A 2,000 KILOWATT STATION.

This station, with a maximum output of 1,030 kilowatts would be equipped with two generating sets of 1,000 kilowatts each, one being a spare. Overload capacity of sets = 15 per cent.

Steam consumption at full load would be 19·5 lb. per kilowatt hour when working with steam superheated 100 deg.—150 deg. F.

Making allowance for engine running on average at two-thirds of full load, and for condensing, forced draught, superheating and feed pump requirements, 24 lb. per kilowatt hour will be a fair figure.

The average daily load factor is taken at 0·63, which is derived from log sheet readings of a plant serving similar purposes. This gives an average daily load of 650 kilowatts.

Evaporation would be about 5 lb. of water per 1 lb. of Transvaal coal.

	£	s.	d.
Coal per hour for average load of 650 kilowatts	0	17	2
Water per hour for average load of 650 kilowatts	0	3	11
Oil, waste and stores per hour for average load of 650 kilowatts	0	1	1
Repairs and maintenance per hour for average load of 650 kilowatts	0	5	5
Staff per hour for average load of 650 kilowatts	0	11	4
Interest and amortisation per hour for average load of 650 kilowatts	1	2	6
Total cost per hour	£3	1	5 = 737d.

Cost per kilowatt hour or unit:—

$\frac{737}{650}$ = 1·133d. per unit at main switchboard.

B.—COST PER UNIT IN A 3,000 KILOWATT STATION.

This station, with a maximum output of 2,140 kilowatts, would be equipped with three generating sets of 1,000 kilowatts, one serving as a spare.

Steam consumption at full load, as before, 19·5 lb. per kilowatt hour.

Average load from small motors (load factor = 0·63)	650 kw.
Average load from 4—400 h.p. mill motors (load factor = 0·9)	1,000 kw.
Average total station load	1,650 kw.

Average load factor would now be $\frac{1650}{2140}$ = ·77 as against ·63 for the first-mentioned station under A.

Allowing for the sets working on average at over three-fourths of full load and for condensing, forced draught, superheating and feed-pump requirements, 23 lb. per kilowatt hour would be ample.

Evaporation as before, 5 lb. of water per 1 lb. of coal.

	£	s.	d.
Coal per hour for average load of 1,650 kilowatts	2	1	9
Water per hour for average load of 1,650 kilowatts	0	9	6
Oil, waste and stores per hour for average load of 1,650 kilowatts	0	2	9
Repairs and maintenance per hour for average load of 1,650 kilowatts	0	13	9
Staff per hour for average load of 1,650 kilowatts	0	14	2
Interest and amortisation per hour for average load of 1,650 kilowatts	1	12	11
Total cost per hour	£5	14	10

Cost per kilowatt hour or unit:—

1·650 kilowatts per hour = £5 14s. 10d. = 1,378d.

$\frac{1878}{1650}$ = 0.836d. per unit at main switchboard.

C.—COST OF ELECTRIC POWER AT MILL MOTORS.

As pointed out under heading A, the cost per hour for the total output of a 2,000 kilowatt station, excluding any mill motors, would be £3 1s. 5d. for an average output of 650 kilowatts. Under these conditions the two mills would have to be driven by separate engines involving a certain expenditure in running expenses. The sum of these two expenditures, viz., running costs of central station with 650 kilowatt oad and of two separate mill engines will have to be

compared with the total running cost of the 3,000 kilowatt station, giving average 1 650 kilowatts per hour and maintaining both the 650-kilowatt small motor load and the 1,000 kilowatt mill motor load.

The cost of supplying 650 kilowatts to small motors should in either case be taken as the same, and can therefore be deducted from the total cost for 1,650 kilowatt supply from larger station to arrive at cost of mill motor power. We then have: Total cost of 1,650 kilowatts = £5 15s. 3d. per hour (as under B) total cost of 650. kilowatts = £3 1s. 5d. per hour (as under A); cost for 1,000 kilowatts = £2 13s. 10d. per hour for mill motor. Cost per mill motor unit at switchboard $= \frac{646}{1,000} =$ 0·646d. 12 per cent. and amortisation on £7,900 for 4 mill motors, 2,500 yards cable and erection $= \frac{12 \times 7,900 \times 240}{100 \times 365 \times 24 \times 1,000} =$ 0·026d. Mill motor attendance, one man at £1 per day $= \frac{240}{24 \times 1,000} =$ 0·01d. Repairs of mill motors and cables, including oil supply = 0·01d.; total cost per unit at mill motors = 0·692d.

Allowing 98 per cent. efficiency of cables and 91 per cent. efficiency of mill motors we have: $\frac{0·692 \times 746}{0·98 \times 0·91 \times 1,000} =$ 0·58d. per bh.p. hour at mill shaft.

If the smaller motors were also to receive the benefit of the cheaper power supply due to mill motor load the price per b.h.p. at mill motor shaft would work out as follows: Cost per unit at switchboard (see B) = 0·836d.; 12 per cent. interest and amortisation for mill motors and cables = 0·026d.; mill motor attendance = 0·01d.; repairs of mill motors and cables, including oil supply = 0·01d.; total cost per unit at mill motors = 0·882d.

Allowing for cable and motor losses we have: $\frac{0·882 \times 746}{0·98 \times 0·91 \times 1,000} =$ 0·73d. per b.h.p. hour at mill shaft.

D.—COST OF ELECTRIC POWER FROM 5,000, 3,000 AND 2,000 KILOWATT STATIONS.

I have drawn up a table showing the various items forming part of the cost per unit in stations of different sizes to show the decrease in cost of production due to increase in size of station.

In the 5,000 kilowatt station the maximum output is taken at 4,280 kilowatts. Load factor = 77 per cent Average load = 3,300 kilowatts. Steam consumption = 22 lb. per kilowatt hour. All the units in the above station are capable of carrying a 15 per cent. overload.

The 5,000 kilowatt staff item allows for two drivers per shift and also includes full salary for the chief engineer. This station would be capable of supplying power to four 220-stamp mills and to the smaller motors distributed over the properties.

In the items of the two large stations no allowance is made for the saving effected through the smaller motors receiving current at a cheaper price, than when being supplied from a smaller station (2,000 kilowatts or less).

The follo wing is a rough estimate of two propositions:

220-Stamp Mill driven by one Steam Engine.

One 770 h.p. direct coupled engine erected ..	£4,500
Condenser plant erected	3,300
Excavations and foundations for engine, condenser and house	2,000
Engine house and gantry	2,000
Proportion of cooling pond and piping ..	2,000
Steam piping to mill	1,000
Spare parts for engine	500
	£15,300

220-Stamp Mill driven by two Electric Motors.

Two 400 h p. motors with switchboards and spares (erected)	£2,500
Motor excavations and foundations	500
Motor house	200
Cables from central station to mill	750
Generating set excavations and foundations (one-half)	500
Generating set erected	4,000
Switchboard extension	400
Proportion of engine house and gantry and piping	1,250
Proportion of cooling pond and piping ..	2,000
Condenser plant erected	3,300
	£15,400

There is no uncertainty *re* the applicability of electric motors for the driving of stamp batteries. This has been proved over and over again in small mills receiving their power by means of electrical transmission of energy from distant water power plants. The effects of vibration can be eliminated by the insertion of a belt drive between cam shaft and main shaft, and by further inserting a flexible coupling between main shaft and motor.

At the present time we find electric motors subjected to far heavier strains, as for instance, in some of the large continental rolling mills, where the motors are direct coupled to the main roller shafting

When dealing with the question of the best form of driving arrangements, I find that it is cheaper and more

efficient to instal two large slow-speed motors in place of a number of small motors in each mill. The following figures will prove the correctness of this.

LARGE MOTORS TO BE PREFERRED.

There is another point in favour of the large motors, and that is that practically all the present forms of drive to camshafts remain unaltered, and there will be no experimenting for the mechanical engineer, whereas an installation of twenty-two small motors calls for a new arrangement of camshaft drives, which, with a motor speed even as low as 250 revolutions per minute, necessitates the adoption of camshaft pulleys of about 15 ft. diameter—by no means an inviting prospect. It is practically not possible to build 40 h.p. motors for working at the same speed as the large motors—that is, at 104 revolutions per minute—as the first cost would be very high and the efficiency and power factor both very low.

Another solution might be the adoption of small back-geared motors. This would lower the first cost, but the efficiency would suffer at the same time. There would also be heavy wear and tear on the high-speed gearing.

The driving of stamp batteries cannot be compared with the driving of workshop tools. In the latter case it often pays to instal a number of small motors in place of group driving to avoid losses in countershafting, as it often happens that a large part of shafting and belting is running idle.

In a stamp mill the countershafting transmits the full load nearly the whole time, and with the arrangement of two motors half the stamps with shafting can be shut down when a reduction in the number of stamps is required. More flexibility will not be required in practice, the couplings allowing for further afteration in number of stamps to be run. When laying out the supply station for two or more mills it is advisable to have a three-phase system with not above 25 cycles per second. Large low-speed motors are not so efficient and also have a lower power factor at 50 cycles. In the case before us the 400 h.p. motors would only have had an efficiency of 89 per cent. and a power factor of 73 per cent., as against 91 per cent. and 86 per cent, with 25 cycle 400 h.p. motors. Also, with the adoption of large central electric stations for power supply to groups of mines, facilities will be given for supplying power to large electric hoists of 1,000 h.p. or more in place of steam winders. As these hoists will be generally arranged with the drums coupled to the shafts of slow-speed motors, the 25 cycle supply will again be the correct one, 50 cycle motors calling for reduction gear on the hoists.

This also applies to the supply of current for large underground pumps of the Riedler type, with direct coupled slow-speed motors.

Another point in favour of taking the power supply for mills from a central electric station is that we thereby increase the total output of such station, which is then in a position to easily cope with the intermittent power demand for any large electric hoists. This extra load, which is often coming on and off, will only form about 20 per cent. or less of total load, thereby causing no appreciable fluctuations in pressure. This was a point brought forward in one of the discussions before the war *re* steam consumption of winding engines.

AN IDEAL LOAD.

A mill load is an ideal one from the load factor point of view, and tends to bring down the cost of current production to a very low figure. Winding plant motors thereby also have the advantage of getting power at a cheap price, which they could never have if driven off small isolated steam or electric plants. The mill motor attendance, although allowed for in my figures, will practically form a negligible item, as same only amounts to keeping the oil supply for the two bearings of each motor in order. The electrician ooking after the other motors on the property also gives the mill motors any necessary attention.

The starting and stopping of large mill motors is as simple as in the case of small motors. The starting could be done by the mill foreman, the stopping by any white man employed in the mill, as this can be effected by simply operating one switch, the starting resistance being attended to before starting up again. The arrangement for immediate stoppage would give greater safety to life and limb than in the case of a steam driven mill, where a considerable time elapses before the engine is brought to a standstill in the event of an accident. With the electric drive only a very short time is required to use up the momentum in motor rotor, countershafting, pulleys and cams after the switch has been drawn.

I am further of opinion that with induction motors the mill can be started up again without undoing the couplings or lifting the stamps beforehand, which undoing, etc., seems to be the present practice.

The mill motors on order for the East Rand Proprietary Mines will give full load torque with not more than 1½ times the full load current when starting.

A good feature of the motors in question is that the efficiency curve shows only a drop of 1 per cent. between a load of 400 h.p. and 200 h.p., the efficiency being 91 per cent. and 90 per cent. respectively.

Paper read before the South African Association of Engineers.

ARTICULATED LOCOMOTIVE FOR THE RHODESIAN RAILWAY.
The smoke stack at the back of the cab is for the exhaust of rear engines.

LOCOMOTIVE FOR RHODESIAN RAILWAYS.

WE illustrate on this page a Kitson locomotive designed for working heavy freight trains over the severe grades and sharp curves encountered on the Rhodesia Railways. This engine is divided into three main portions—the superstructure and two steam-driven trucks. The superstructure consists of boiler, coal bunker, water tanks, and cab, which rest on two long girders, that are themselves carried at two pivot points on the six-coupled trucks. By this means the whole weight of the engine is upon the coupled wheels, and is, on that account available for adhesion.

It can be accurately adjusted by means of a special spring connection, introduced at a selected position away from the centre of the bogie; and as the wheel-base of each engine is not more than 8 ft. 6 in. the engine can pass round curves of three chains radius without causing the slightest injury to the road-bed. In addition to the advantage of traversing these severe curves, the line of pull from the engine itself is kept in a position which reduces the side resistance at the pulling end. Each bogie is in itself an engine, with a pair of cylinders, valve motion, brake gear, and sanding gear complete, and bears the weight of half of the superstructure on a recessed steel casting. There are bolts passing through solt holes in these castings, which form a connection between the bogie and the superstructure, and a further security against an excess of movement is provided by the addition of check chains.

The mechanical details by which the power is supplied and controlled for each of the bogies have been carefully designed. The steam is carried from the front end of the boiler by means of ball-and-socket joints to each pair of cylinders. The exhaust of the front bogie is carried through the smokebox, and is sufficient to keep up a draft through the fire-box, and so maintain steam. The exhaust steam of the hind bogie is passed into the atmosphere, but could be utilised either for the purpose of increasing the draft or for an exhaust steam injector, if required. The driver supplies steam to both sets of cylinders by one movement of the regulator handle, and in the same manner he is enabled to reverse both engines, put the brake on, and actuate the standing gear by one movement of each of the handles concerned. There is no difference in the method of lookout, or of handling the engine, from the practice of ordinary locomotives. The boiler is of the "Belpaire" type. The locomotive has been built by Messrs. Kitson and Co., of Leeds, and the engine is now regularly drawing twice the train loads formerly hauled by the most powerful locomotives on the Rhodesian Railways.

Each bogie has six wheels coupled, each of 4 ft. diameter, and two outside cylinders of 16 in. diameter by 24 in. strike. Other dimensions are, heating surface, firebox, 136 square feet. tubes, 1,590 square feet; total heating surface, 1,726 square feet. Grate area, 34 square feet. Internal diameter of boiler, 5 ft. Length of boiler, 13 ft. 4 in. Thickness of boiler $\frac{9}{16}$ in. Boiler pressure, 180 pounds per square inch. Length of firebox, 8 ft. 3 in. Height from rail level to top of funnel, 12 ft. 10 in. Height from rail level to centre of boiler, 7 ft. 2 in. Rigid wheelbase, 8 ft. 6 in. Total wheel-base, 34 ft. The engine tank has a fuel capacity of three tons of coal.

IRON ORE DEPOSITS ABROAD.

POSSIBLE FIELDS FOR FUTURE ENTERPRISE.

(*Continued from page* 253.)

SPAIN.

THE best and most important deposits of iron ore are the property of two mining companies—viz., the Dicido Iron Ore Company, Ltd., of London, who have been working their properties since 1880 at the rate of over 150,000 tons yearly, and the Compania Minera de Setares, of Bilbao, which started working in 1886 with a similar output.

The quality of these ores is superior to that of other deposits in the district, the metallic iron ore being over 49 per cent., as received, and silica 9 per cent.

Major Nutt, Vice-Consul at San Sebastian: Deposits of iron ore exist in the watersheds of the Rivers Bidasoa, Urumea, and Oria, extending to the frontier of Navarre. The proprietors, whether rich or poor, have not hitherto been generally disposed to work or prove their mining concessions, but are slowly beginning to see that they must accept reasonable terms for virgin mines. Hitherto they have hindered the industry by asking unreasonable terms for the privilege of proving their properties. The mines near Irun, so far as they have been proved up to date, would show that spathic or carbonate of iron predominate, and the Vice-Consul is informed that the system of calcining the ore has not been perfected, on account of the great amount of "smalls." If the calcining process could be carried out to avoid the making of so large a percentage of "smalls" by transforming the calcined ore into "briquets," or by any other means, a much larger export might ensue. From the Bidasoa district alone, but for the above-mentioned difficulty, it is stated that from 200,000 to 300,000 tons of iron ore per year ought to be available.

In Santander most of the mines are being worked by companies (the larger being English). Heavy prices have been paid for mining property in this district. The larger mines have been working for the last twelve years; previous to that, only the lumpy ore was worked. Companies ship individually up to 200,000 tons per year to the United Kingdom, Germany, and Holland. Total shipments for past five years, about 4,000,000 tons. The great obstacle to mining in Santander district is the difficulty of obtaining depositing ground for the slimes from the washers. The formation is dolomite. The mineral has to be separated from the clay by washing. The average percentages of clays to minerals run from 15 to 35 per cent.

ENORMOUS DEPOSITS IN HUELVA.

In the Seville district it is reported that the majority of the proprietors would be disposed to sell their deposits on reasonable terms. The deposits that have hitherto been worked are those of the "Cerro del Hierro," in San Nicolas del Puerto, which are leased by Messrs. William Baird and Company, of Glasgow, who have exported during the last five years over 1,500,000 tons of ore to Glasgow, Ardrossan, Ayr, and Bo'ness.

There are enormous quantities of iron ore in the province of Huélva. All the "outcrops" ("crestonages") of the pyrites mines which are disseminated through the whole province are composed of peroxide of iron, and a large proportion of the "overburden," which is removed for working the pyrites by "open casts." All the pyrites mine owners have large heaps of mineral, but not in a fit state for immediate shipment, it having been dumped down anywhere and anyhow, neither cleaned nor classified, but mixed with any other stones which may have come down with it. The proprietors of the mines range from companies of such importance as Rio Tinto, Tharsis, and Pena de Hierro, to the very small owners, who only find it profitable to work even their copper ore when the price of copper is high, at least above £50 to £55. Owners of reasonably sized deposits being mine owners, would probably only sell by contract, but would most likely be glad to make favourable terms.

The principal obstacle in the way of successful continuous and unencumbered mining in this district of iron ore is probably the quantity of sulphur contained in the mineral. Another will always be that it pays both the private and public railway lines better to handle, as they do at present, to their full capacity, the copper ore and precipitates rather than low-grade iron ore.

CORUNNA DISTRICT.

In the Corunna district, which has many iron deposits, there are rich and poor proprietors, who would only be too glad to sell or lease on condition of receiving a small royalty per ton. The Baamonde basic ores average from 50 to 55 per cent. of metallic iron, with 3 per cent. of manganese, and about 0·3 per cent. of phosphorus. The Puebla del Brollon and Incio basic ores average from 53 to 64 per cent. of metallic iron and 5 per cent. of manganese, and very little phosphorus

VIVERO DEPOSITS.

Mr. Vice-Consul Lopez describes the deposits of iron ore in the Consular district of Vivero. Several proprietors are willing to sell. During the last four or five years many engineers, both Spanish and foreign, have visited the iron deposits of this district, but no one remained more than two or three days, which naturally is not sufficient to form a true idea of the mineral richness which exists.

The highest outcrop of the Silvarosa is at about 400 metres above the level of the sea. The lode is exposed for a distance of 1,000 metres, with a width varying from 35 to 10 metres; there are signs of mineral having been extracted at levels of 150 metres below the highest outcrop, and all this in continuous mineral rock. In the Muras group there are outcrops at a height of over 1,000 metres above sea level.

The people in general, if, perhaps, at one time they were indifferent to all mineral exploitation, when they saw the good results which the Vivero Iron Ore Company, Ltd., gave to the district, have entirely changed, and to-day, not only could one count upon their support, but capital would also willingly be invested with this object, but not in large sums, as they do not exist.

Many iron ore deposits have been explored and opened up in the Malaga immediate district, but few, if any, of them are in full working order. The mines are generally held for sale or lease, with owners participating.

There are iron ore deposits in the vice-consular district of Castro Urdiales, several of which have been worked for a good number of years. Some of the proprietors would no doubt be willing to sell at a fair price.

Very large and important deposits of iron ore exist in the Aguilas Consular district. Many have been and are being worked, and many are passive, awaiting development. The proprietors are open to sell or lease.

The ore deposits in the immediate Carthagena district are reported as being gradually played out and it is difficult—almost impossible—to now get large quantities of high-grade ores. In fact, the percentage of iron contained in the ore has fallen off considerably from what it used to be. There is a great field, however, in the Cehegin-Calasparra district, where it is averred by experts there are millions of tons of magnetic ore containing in the neighbourhood of 60 per cent. of metallic iron.

There are abundance of mines of all classes to be had in the Garrucha district. The proprietor of the Serena group, consisting of mines, workings and concessions covering 628 acres of ground, would be willing to sell on reasonable terms; many other sets could be obtained on reasonable terms, and a large mineral bearing estate formed.

The mines at Bedar are now worked by two large companies, one a French company domiciled in Paris, the other a rich Bilbao one.

There are numerous iron mines in the province of Granada, principally in the neighbourhood of Gaudix and in the district of the Alpujarra. The iron ores of this province are of 55 to 70 per cent. richness. Probably as a rule sales would not be difficult if serious offers were made.

NORWAY.

In Western Norway there are some important deposits which are described by Mr. J. Logan Lobley.

The mining claims that are the subject of this report may be conveniently considered as forming four groups, with the following designation: The Sellevold group of claims; the Sordalen group of claims; the Georlanger group of claims; the Loland group of claims.

The Sellevold exposures clearly indicate the existence here of a large amount of good ore, and their position is most favourable, as they are at a suitable elevation above sea-level, from 100 ft. to 300 ft., and are within a kilometre from the shore of the fjord, near to which large ships could be safely moored. The whole of the Sellevold claims are along a line running east by north to west by south, and the ore may be continuous along this line, if followed below the surface, in which case there would be a very great development of valuable ore, but from the varying quality of the ore and the mode of its occurrence, the writer of the report is of opinion that although following the strike of the rocks, which dip at a high angle, the masses of ore are not continuous. There is, however, a sufficient amount of good ore at Sellevold to justify mining operations, which could be here commenced at very little cost and from the suitable elevation of the ore above the level of the fjord, it could be most conveniently and economically shipped.

At Sordal the ore is seen to be of the same character as that at Sellevold, namely, titaniferous iron ore, and the rocks in which the ore occurs are similar also.

The ore seen at all the exposures is good and compact and more distinctly separated from the country rock than at Sellevold. The rocks and the inter-bedded masses of ore dip at the high angle of 60 deg., and the direction of the dip and the position of the outcrop of the ore is favourable for easy and economical working and transport.

(To be continued.)

THE FRENCH CRUISER "JEANNE D'ARC."

Length, 475 ft. 8 in.; beam, 63 ft. 8 in.; draught, 26 ft. 8 in. (aft). Displacement, 11,270 tons; nominal speed. 23 knots. Engines: Three sets vertical, 3 expansion, 48 Du Temple boilers. Armour: Complete steel belt 5·9 in. thick and 7 ft. 3 in. deep; main turrets, 17·8 in.; maindeck casements and secondary turrets, 5·9 in.; stern gun, 4 in. base; bow gun, 3 in. Protected deck, 2·6 in., curved behind belt; splinter deck, 1 in. Armament: Two 7·6 in. breechloading, singly in turrets; fourteen 5·5 in. quick-firing, eight on main deck, six in turrets on upper deck; sixteen 3-pounder quick-firing; eight 1-pounder quick-firing; two Maxim machine guns, and two submerged torpedo tubes.

LAUNCHES.

On Tuesday, the 1st inst., there was launched from the yard of the Tyne Iron Shipbuilding Company, Ltd., of Willington Quay-on-Tyne, a steel screw steamer built for Messrs. Harris and Dixon, Ltd., of London, and of the following dimensions, viz., length, 348 ft. 6 in.; breadth, 50 ft.; depth, 25 ft. 8 in., and to Class 100 A 1 at Lloyd's, with single deck laid. The engines, which are supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne, are of the triple-expansion type, having cylinders 24 in., 39 in., and 66 in., by 45 in. stroke, and working at a pressure of 180 lb. On leaving the ways, the vessel was named the *Aphrodite* by Mrs. H. M. Rogers, of London, wife of the superintendent of the owners.

Messrs. William Gray and Co., Ltd., launched the handsome steel screw steamer *Harlingen* on the 2nd inst. She will take the highest class in Lloyd's, and is of the following dimensions, viz: length overall, 353 ft. 6 in.; breadth, 49 ft. 6 in., and depth, 25 ft. 2 in., with extra long bridge, poop and topgallant forecastle. The hull is built with deep frames, clear holds, cellular double bottom and aft peak ballast tank, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25½ in., 40½ in., and 67 in. diameter, with a piston stroke of 45 in. and two large steel boilers for a working pressure of 180 lb. per square inch.

The same Company launched, on the 3rd inst. the steel screw steamer *Havre*, which they have built for Messrs. Frank C. Strick and Co. Ltd., of Swansea and London. She will take the highest class in Lloyd's, and is of the following dimensions, viz., length over all, 299 ft.; breadth, 39 ft.; and depth, 22 ft. 4 in. She is a handsomely-modelled vessel of the singe-deck type, with engines aft, having long poop, short bridge, and topgallant forecastle. The machinery is made by the Central Marine Engine Works of the builders, being of the triple-expansion type, with cylinders 22 in., 35 in., and 59 in. diameter, with a piston stroke of 39 in. She is fitted with two large steel multitubular boilers, with Howden's forced-draught working at a pressure of 180 lb. per square nch.

The new steamer *Rheinfels*, the latest addition to the fleet of the Deutsche Dampfschifffahrts Gessellschaft, "Hansa" of Bremen, sailed from the Tyne on Tuesday, the 1st inst., after a very successful trial trip. The vessel has been built by Swan, Hunter and Wigham Richardson, Ltd., and is 435 ft. in length, by 55½ ft. beam, fitted with four-crank quadruple expansion engines on the Yarrow, Schlick and Tweedy system. The steamer is intended for the "Hansa" Company's eastern trade, and will carry over 8,000 tons dead-weight on a light draft of water.

On Wednesday, the 2nd inst., another steamer, the *Arensburgh*, was launched by the same builders for the Hansa Co. This second vessel is 400 ft. in length by 51 ft. 9 in. beam. She will also be fitted with a set of four-crank quadruple-expansion engines on the Yarrow, Schlick and Tweedy system, and these, as well as the boilers, are being built by Swan, Hunter, and Wigham Richardson, Ltd.

There was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, on the 3rd inst., a handsomely-modelled steel screw trawler, the principal dimensions being 115 ft. by 21 ft. 6 in. by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Messrs. Pecheries a Vapeur, of Ostend, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes and Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes.

A remarkable looking vessel, the *Wrecker*, has just been launched from Messrs, Ramage and Ferguson, Ltd.'s shipbuilding yard. The *Wrecker* is 140 ft. long, 30 ft. beam, and 13 ft. hold. She will be propelled by twin-screw engines made by Messrs. Ramage and Ferguson, Ltd. When completed, she will, it is stated, be among the most powerful salvage steamers in the United Kingdom. Her steam pumping power will be fully 4,000 tons per hour; she will be provided with all the latest improvements in pneumatic drilling and cutting tools, electric light throughout, also a portable sawmill driven from one of her powerful steam winches. There is accommodation for forty persons on board. The *Wrecker* is the second salvage steamer the builders have constructed for the East Coast Salvage Company, Ltd.

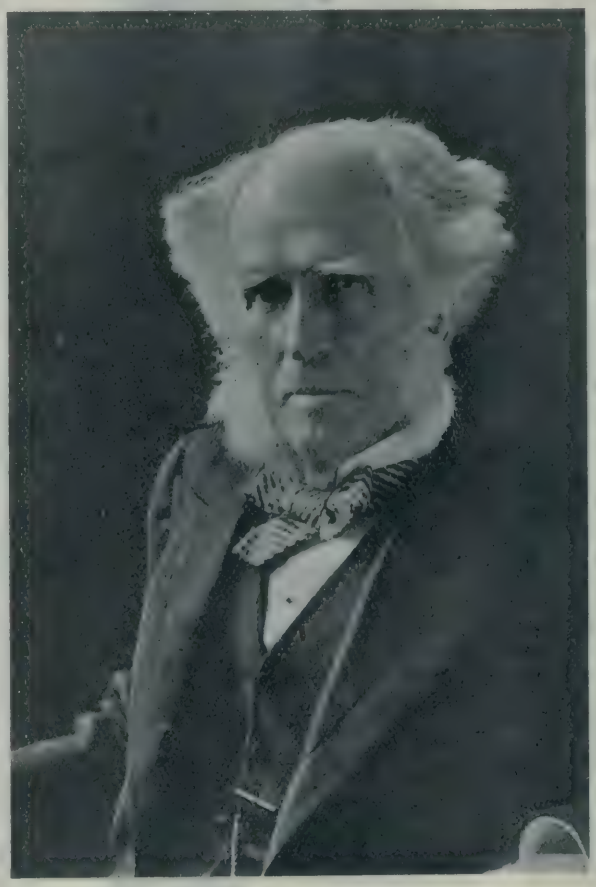
THE FRENCH CRUISER "MONTCALM."

Length, 452 ft. 9 in., 460 ft. over all; beam, 63 ft. 8 in.; draught, 24 ft. 6 in.; displacement, 9,516 tons. I.H.P., 19,600=21 knots, forced. Engines: 3 sets vertical, 3 expansion, and 20 Normand boilers. Armour: 6 in. Harveyed nickel steel belt, ending a short way from the stern in a 3·4 in. transverse bulkhead; upper belt, 3·7 to 2·4 in., does not reach up to maindeck casemates; protected deck, 2 in., and splinter deck. Turrets, 6 in., with 4 in. bases. Armament: Two 7·6 in. breechloaders in two armoured turrets fore and aft; eight 6·4 quick-firing in casements; four 3·9 quick-firing in shields; sixteen 3-pounders quick-firing; six 1-pounders, or revolving; and two submerged torpedo tubes.

OUR WEEKLY BIOGRAPHY.

SIR GEORGE BARCLAY BRUCE, M.Inst.C.E.

AMONG the railway engineers of the present day it would be difficult to find any whose claims to distinction are more solidly grounded than those of the Novocastrian veteran, Sir George B. Bruce. Born at Newcastle-on-Tyne in October, 1821, he received his preliminary education at an academy of which his father was principal, and at which Robert Stephenson himself was educated. On reaching the age of fifteen, he was articled to Robert Stephenson, who evinced a keen interest in his pupil. Mr. Bruce remained in the mechanical department of the northern locomotive works for about five years, during which time he gained a varied and valuable experience. On the expiration of his pupilage, he was engaged until 1844 on the construction of the Newcastle and Darlington Railway—a line which formed the connecting link between Newcastle and the metropolis.



SIR GEORGE BARCLAY BRUCE, M.INST.C.E.

His next position was that of resident engineer on the Northampton and Peterborough Railway, on the completion of which, in 1845, he occupied a similar post on the northern section of the Newcastle and Berwick Railway. While in this position he was resident engineer of the Royal Border bridge, which spans the Tweed at Berwick—an enterprise which was inaugurated by Queen Victoria in 1850. Up till this date Mr. Bruce had remained in the service of Robert Stephenson. Immediately afterwards he became engineer-in-chief on a short line, from the Newcastle and Carlisle Railway to Alston Moor. Although Sir George's plans were carried out on this work, he did not remain to see the completion of the undertaking, for, to use the words of Robert Stephenson, "while on this work he was called upon to enter a new sphere of action—to go to foreign countries to execute railways where appliances were nil, where the people differed from him in sentiments, in feeling, and in language, and where, in fact, everything was adverse to him."

Sir George commenced his career in India by taking charge of the Calcutta section of the East Indian Railway. Early in 1853 he was transferred to Madras, where he was

appointed chief engineer of the new railways in that presidency. This is the work which stands out most prominently in his professional career. At the outset there were many obstacles of no ordinary description to overcome, but in a few months the general course of the line, about five hundred miles in length, was decided upon. The construction of the railway was carried out with rigid economy; under Sir George's system the services of large contractors were dispensed with, and the abolition of the custom of paying the Hindoos in advance of their labour was mainly due to his instrumentality. The collection of labourers by impressment was severely discountenanced by Sir George, who, instead of violating the rights of the subjects, enlisted them into the company's service by appealing to their free will and gaining their confidence. In December, 1856, Sir George was obliged to return home on account of illness, but before he left India he was able to witness the completion of the first section of the line, the mileage of which was opened for public traffic at an exceptionally small cost. On retiring from his position as chief engineer of the Madras Railway he was entertained at a dinner in London, where Robert Stephenson presided, and presented with a very valuable service of silver plate by the Company's officials and servants.

Having regained his health, Sir George continued to act professionally for railway companies of India, and was engaged as consulting engineer to the South India and the Great Indian Peninsula lines. Among other enterprises abroad and in the Colonies upon which he was engaged may be mentioned the New Zealand Railways, the Beira Railway, various harbour works, railways and tramways in South America, and the Rio Tinto Railway and pier. He was a member of the Royal Commission on Metropolitan Water Supply in 1893 and 1898, of which Lord Balfour of Burleigh and Lord Llandaff were respectively chairmen.

Sir George Barclay Bruce became a Member of the Institution of Civil Engineers in 1850. His contributions to the literature of the Society include a description of the Royal Border bridge on the York, Newcastle and Berwick Railway, and a description of the method of building bridges upon brick walls in sandy foundations in India illustrated by the viaduct over the river Poiney, on the line of the Madras Railway. He was elected President of the Institution in 1887, and in 1888 was again chosen for that office, during which year he received the honour of knighthood.

MR. FREDERIC SHELFORD.

Mr. Frederic Shelford, whose portrait appears on page 281, is a son of Sir William Shelford, and the active partner, since the retirement of his father, last year, of Sir Benjamin Baker. Although belonging to the younger generation of engineers, Mr. Shelford has already accomplished a vast amount of the pioneer work in connection with the British Government Railways in West Africa. In 1897 he visited Lagos and Sierra Leone, while in 1899 he again travelled in Sierra Leone and on the Gold Coast. Later on he was engaged in Egypt, which country he also had occasion to visit in the early part of this year. Mr. Shelford acted as consulting engineer to the Lagos Railway, the Gold Coast Railway, and also to the Sierra Leone Railway, the last section of which was recently completed, and will probably be opened for traffic during the present month. The line runs from Freetown to Baiima, *via* Rotifunk and Bo, the total length being 222 miles. The undertaking was inaugurated in March, 1896, and the rate of construction has averaged 2·7 miles per month. The maximum gradient is 1 in 60, the minimum curve is five chains, while the average cost of construction was £4,300 per mile. Mr. Shelford thinks that the most important railway now needed is one in Northern Nigeria to Kano and we understand that details of this project will be available in a forthcoming blue-book.

SELF-ACTING, BORING, SURFACING, SCREW-CUTTING, AND STUD-TURNING LATHE. WITH VARIABLE FEED.

BY THE CARRON COMPANY, STIRLINGSHIRE, N.B.

THE lathe herewith illustrated is a useful machine designed by the Carron Company to meet the requirements of firms which sometimes involves a special demand for studs or short screws, not sufficient in quantity, however, to warrant the purchase of a special stud lathe. The lathe takes in work 21 in. diameter, with a limit of 18 in. between the chuck and saddle. The cone has three steps, respectively 8 in., 10 in. 12 in. diameter by 3½ in. broad. The wheels have teeth machine-cut from the solid blanks, and, by means of a friction clutch, the spindle is changed, from belt to gear drive.

The spindle has 2⅛-in. hole right through, and runs in phosphor bronze bearings, and fitted at tail end with steady chuck, the back bearing being formed as a thrust block. The gears on the quadrant or swing plate are constant, and the standard pitches of screws, from 2 to 20 per in. can be cut by changing the wheel on the screw only. An index and table on face of quadrant gives the necessary wheels for the different pitches, and the position when in proper gear.

The variable feed is fixed at a ratio of 1 to 4, and by a change of wheels on back shaft quadrant, feeds from $\frac{1}{16}$ in. to $\frac{1}{220}$ in. per revolution of spindle can be obtained, the ratio being controlled by lever at front of lathe. The leading screw is made of hard cast steel and machined by means of a master screw, Whitworth pitch. The clamping nut is made in halves, ensuring the maximum bearing round the screw. The rack for traversing saddle has teeth cut from solid cast iron, and the pinion from mild steel blanks.

The cast steel forged turret tool holder takes four tools, having a positive fixture, ensuring perfect rigidity, and by a special arrangement the rest can be fixed at an angle of 55 deg. when screw-cutting "V" threads, Whitworth pitch, a method which is found much superior to ordinary practice, inasmuch as the tool is not pressed forward in wedge fashion.

By an arrangement of gear which connects the back shaft to the screw, the operation of turning or screw-cutting can be changed at pleasure, by means of a shaft placed under the screw, and by a lever on left side in front of saddle. A patent combined screwing die and steady rest is supplied to fit on the saddle, so that studs or screws may be made from the solid bar, as illustrated on opposite page.

The four-jaw expanding chuck is provided with auxiliary steps, whereby a greater range of diameters can be gripped. The counter gear includes one shaft, two hangers, a three-step cone to match the cone on lathe head, one fast and two loose pulleys, and a positive belt shifting apparatus. The wheels on head are neatly covered to protect the operator from accident.

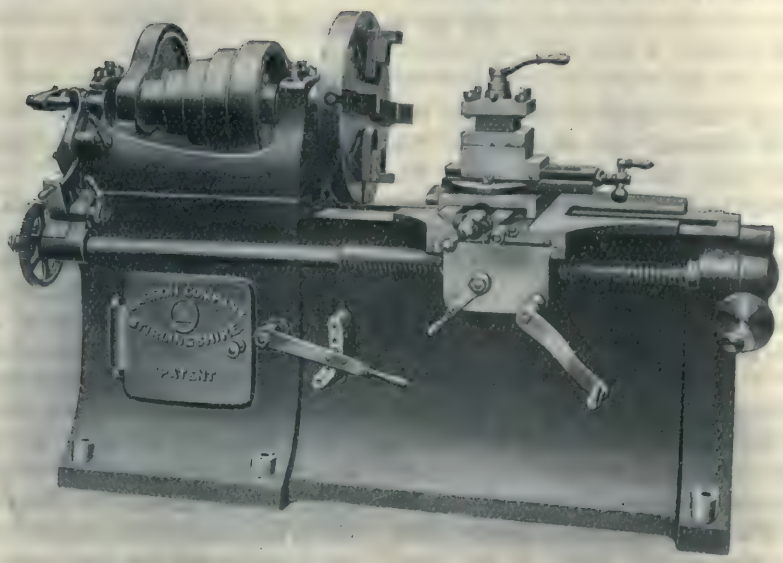


FIG. 1. THE MACHINE AS A SURFACING LATHE; THE SPINDLE IS CHANGED FROM BELT TO GEAR DRIVE BY FRICTION CLUTCH.

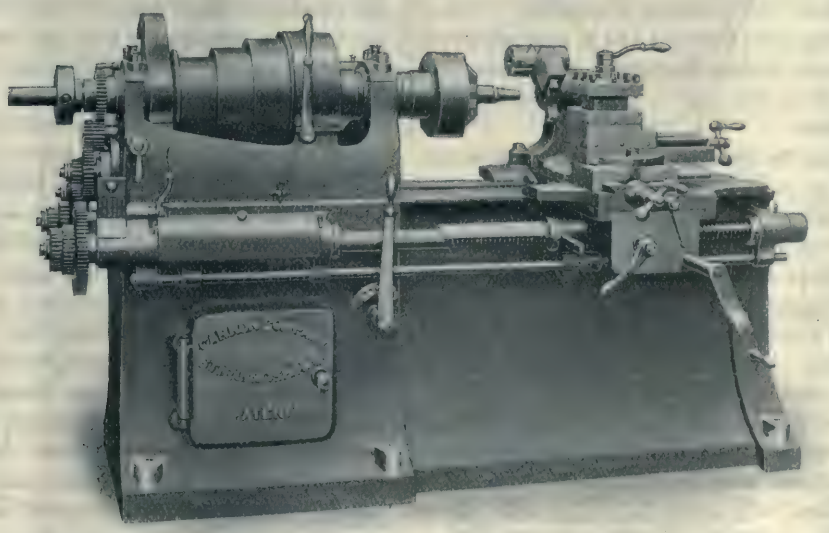


FIG. 2. AS A STUD LATHE; A PATENT COMBINED SCREWING DIE AND STEADY REST IS SUPPLIED TO FIT ON THE SADDLE.

COUNTERWEIGHTS FOR LARGE ENGINES.

By D. S. JACOBUS.

THE writer was called upon to investigate the problem of lessening the vibration of the engines at the new power plant at the Manchester St. station of the Rhode Island Co., Providence, R.I., and working conjointly with Mr. Fred N. Bushnell, the chief engineer of the company, he recommended that certain counterweights be added to those already on the engines. These counterweights, which were exceptionally large, were adopted, and gave satisfactory results.

In addition to the problem of lessening the vibrations certain electrical problems arose regarding the effect of the counterweights in increasing the variation in angular velocity of alternating current generators run in parallel with each other. A number of measurements were made to determine the action of the counterweights, both as affecting the vibration of the building and the tendency of the alternating current generators to break apart when run in parallel.

The counterweights were applied to three engines, all of which were of the same cylinder dimensions and had the same weights of reciprocating parts. The engines were of the horizontal cross-compound type directly connected to electrical generators. Two of the engines, designated as Nos. 1 and 2, were connected to 1,500 kilowatt alternating-current generators, and one, designated as No. 3, to a 1,600-kilowatt direct-current generator.

On inspecting the plant it was evident that something should be done to diminish the shaking. The entire building rested on piles which passed through silt for about 30 ft. before striking a solid bottom. There was a mass of concrete about 5 ft. thick placed on these piles, which extended under the entire plant so as to form a bed on which rested the foundations of the buildings, boilers and engines. The bed of concrete also extended under the chimney foundation. When the first observations were made the buildings were not completed. All three engines were, however, installed, and were protected by a temporary wooden structure. The boiler plant was in the process of construction, much of the brickwork having been laid, and the steel framework of the building nearly completed. A portion of the boiler plant was running to supply steam to one of the engines. The chimney, which was ultimately to be about 300 ft. high, was being erected. This was built of special brick furnished by the Alphons Custodis Chimney Construction Company.

MEASURING THE VIBRATION.

The engine which was running was that designated as No. 3, and it shook the entire foundation to such an extent that the motion could be readily felt by a person standing thereon. When water was poured outside of sheet piling, which surrounded the foundation, the surface of the water could be seen to move up and down in time with the strokes of the engine.

After inspecting the plant the writer constructed an apparatus on the principle of the seismograph for measuring the amount of vibration. On a second visit to the plant the horizontal shake of the foundation was measured with this instrument with engine No. 3 running, and found to be 0·01 in. at the engine. This may not seem to be a large amount, but as the entire mass of the building foundation shook, the movement of parts of the temporary wooden building was magnified in many places so as to be very evident to the eye. Furthermore, the ironwork of the boiler-house shook considerably. That the entire mass of the foundation shook could be appreciated by feeling the vibration through the feet, and also by measuring the actual amount at different points with the special apparatus.

At a point near the extreme end of the foundation where the No. 1 engine was located the foundation was found to shake 0·008 in. Measurements made near the top of the chimney, which was erected to the height of about 175 ft. above the ground, showed that the maximum shake with the engine running at its ordinary speed of 90 revolutions per minute was about 0·02 in. After measuring the vibration of the chimney with the engine running at its ordinary speed the engine was shut down, and a marked result took place when its speed fell in harmony with the time of vibration of the chimney. When this occurred the chimney shook to such an extent that the motion was beyond the range of the special instrument. The total movement of the pointer of the instrument was such that the chimney was shown to move more than $\frac{1}{8}$ of an inch. In constructing the chimney the workmen had noticed that when they came to a height of about 130 ft. the vibration was much greater than it

was after the chimney was built higher. This made it appear that at the height of 130 ft., at which there was the most shake, the time of the vibration of the chimney was in harmony with the number of revolutions made by the engine.

As the entire plant shook laterally on top of the piles, and as there could be no vertical movement, it appeared evident that the best plan would be to place counterweights on the engines of such sizes that they would diminish the horizontal shaking forces to nearly a minimum irrespective of the vertical shaking forces which might be produced. This would give much larger counterweights than are ordinarily used, but on carefully considering the conditions which existed it was deemed best to adopt them.

COUNTERWEIGHTS ON FLYWHEELS.

The counterweights originally on the engines were comparatively small, and it was found impossible to place large enough weights on the crank discs to carry out this plan. It was therefore decided to place counterweights on the flywheels in addition to placing as heavy counterweights as possible on the crank discs. A counterweight on the flywheel acts just as efficiently as one placed on the crank disc in eliminating the shaking forces tending to translate the bed of the engine, but with such a counterweight there remain forces which act as couples and tend to shake the engine by rotating it about its centre of mass. The horizontal forces tending to produce translation were, however, the most important in the case under consideration, and these were considered irrespective of the forces tending to produce rotation.

The weight of the counterweights recommended to be added in addition to those already on the No. 3 engine was 4,995 lb. on each of the crank discs, and 3,600 lb. in the flywheel, the distance of the centre of gravity of the weights on the crank discs from the centre of the shaft being 2·38 ft. and for the weight in the flywheel 7·67 ft. The counterweights originally in each crank disc amounted to a net weight of 1,740 lb. at 2·05 ft.

The position of the flywheel counterweight and the

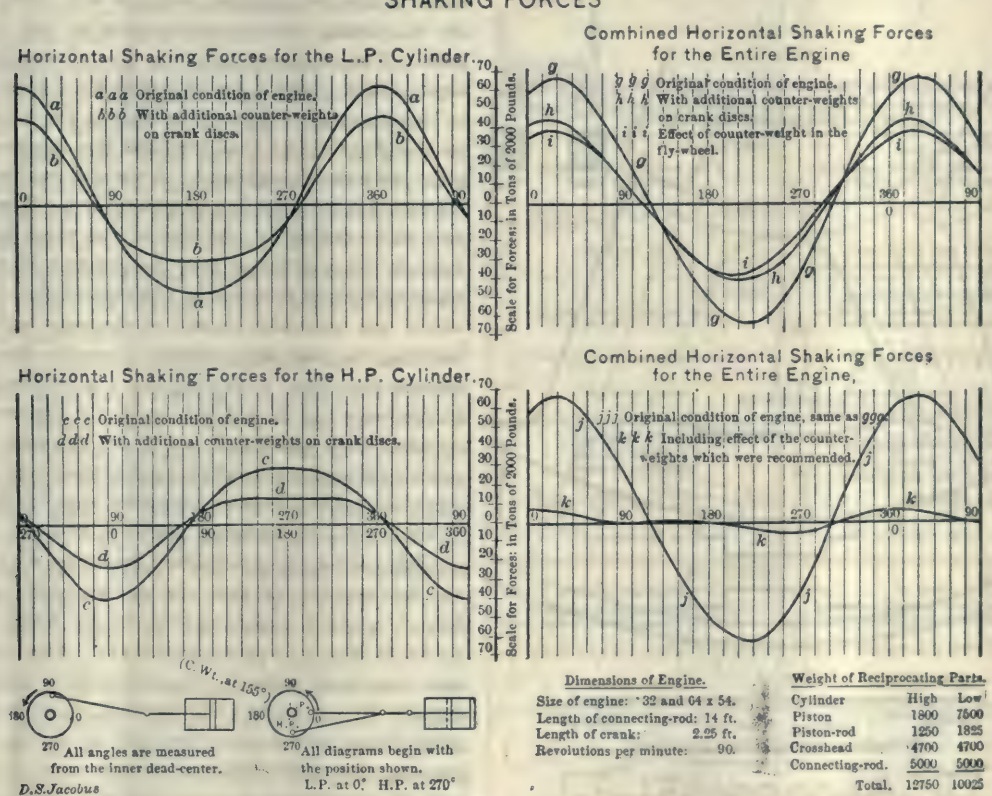


FIG. 1.

SHOWING POSITION OF FLYWHEEL COUNTERWEIGHT, AND SHAKING FORCES, WITH AND WITHOUT ADDITIONAL COUNTERWEIGHTS.

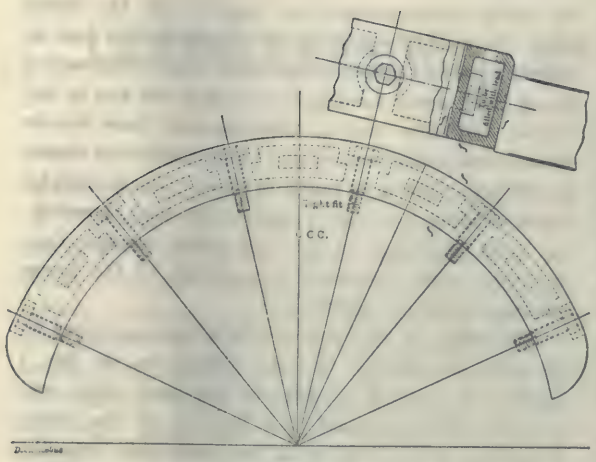


FIG. 2.

COUNTERWEIGHTS FOR NO. 3 ENGINE.

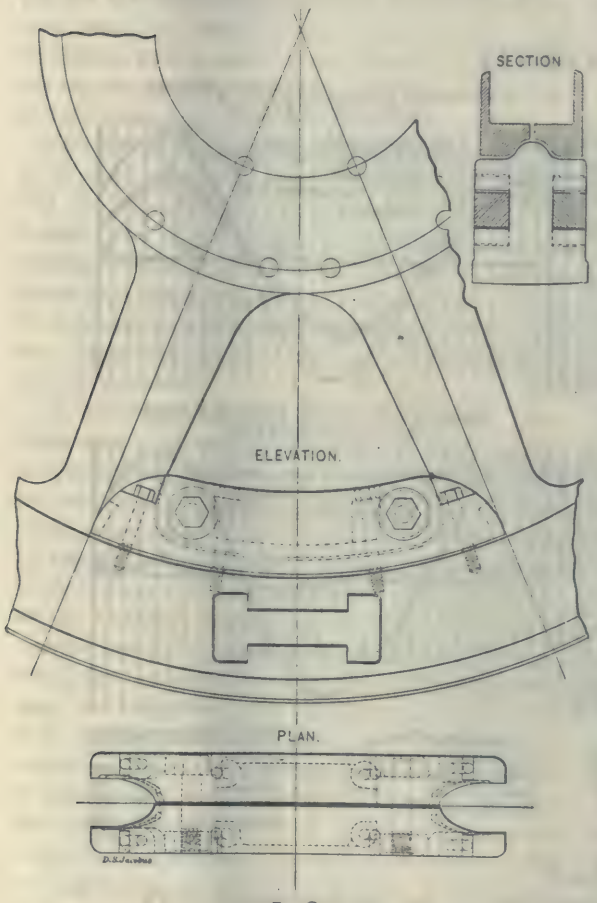


FIG. 3.

COUNTERWEIGHTS FOR NO. 3 ENGINE.

shaking forces with and without the additional counterweights are shown in fig. 1.

THE METHODS EMPLOYED.

Mr. Bushnell designed counterweights for the No. 3 engine to conform with the above sizes. These counterweights are shown in figs. 2 and 3. The counterweights finally placed on the engine were somewhat lighter than called for, but not enough so as to produce any great difference in the results.

On starting up the No. 3 engine with the counterweights it ran without appreciable vibration, and operated with entire satisfaction.

Counterweights were then placed on engines No. 1 and 2 driving the alternating-current generators. As the dimensions of these engines and the weights of the reciprocating parts were the same as for the No. 3 engine, the same size of counterweights were used as for the latter, but those placed in the revolving fields were necessarily of a different form to that employed in the flywheel of the No. 3 engine. In these engines the high-pressure crank leads; whereas the low-pressure leads in the No. 3 engine, and this was taken account of in placing the counterweights in the revolving fields. The counterweights for the revolving fields of engines Nos. 1 and 2 are shown in fig. 4 (page 309).

There was some delay in arranging for a third visit to the plant. The buildings and the chimney of the plant were then completed. A vertical engine directly connected to a 2,500-kilowatt generator had been erected, and was running in addition to the three horizontal engines. It was found that the greatest shaking that could be noticed occurred on the switchboard platform, which was anchored to one of the side walls of the building at a point some distance above the floor. When engines No. 1 and 2, driving the 1,500-kilowatt alternators were run in parallel with the counterweights opposed they produced but little vibration. When run with the counterweights together there was a greater vibration. The greatest vibration that could be detected on the switchboard platform with the counterweights of the two alternating machines together and all the engines in the station running, including Nos. 1, 2 and 3, and a vertical engine which is designated as No. 4, was about ·023 in. This maximum shake occurred when the counterweights of the three engines, Nos. 1, 2 and 3 fell together, which would take place about once every 15 seconds, as the two engines running the alternators ran at about 94 revolutions per minute, and that driving the direct-current machine at 90 revolutions per minute. The amount that the floor shook was measured, and was found to be extremely small, and less than ·002 in.

AMOUNT OF ANGULAR VARIATION.

The ground was frozen during the above test, and it was decided that it would be best to make a final set of observations of the amount of shaking after the frost was entirely out of the ground. Furthermore, some questions arose as to the possible danger of the alternating-current generators breaking out of step when run in parallel with their field counterweights opposed, because when so run the ammeters attached to the generators swayed considerably, indicating fluctuations in the current.

On looking through the magnets of the revolving fields of one of the alternating-current generators at the revolving field of the other the angular variation back and forth was apparent. This was carefully estimated, and under the ordinary conditions of running was found to amount to from about 6 to 8 pole-degrees total variation, or from about 3 to 4 pole-degrees for each machine. The amount of this angular variation with the machines running in parallel was about the same irrespective of the position of the counterweights with reference to each other, but when the counterweights were opposed the variations occurred every stroke, or about 94 times per minute; whereas, when the counterweights were together, or nearly so, the variations occurred at less frequent intervals, the total number of such variations then being from about 30 to 40 per minute. As the total displacement of the two fields from their true position, as observed by looking through the magnets of one revolving field at the other, was about the same irrespective of the relative positions of the two counterweights, it follows that this displacement was produced as much through governor action as through any variation in speed during a single stroke.

When the two alternating machines were operating in parallel there was a swaying of the ammeters in the machine circuits. This swaying was, however, of an entirely different frequency from that of the strokes of the engines. The amount of this swaying was noticed for different relative positions of the counterweights of the engines. The engines were operating at that time under light loads. The voltmeter reading was also quoted, and found to be steady in every instance.

It appeared that the fluctuations in the current generated by the two alternating machines had but little influence on their efficiencies, and that they were working successfully when connected in parallel. The writer did not wish, however, to give an opinion on the electrical side of the problem, and arranged with Professor Albert F. Ganz, the Professor of Electrical Engineering of the Stevens Institute, to accompany him at the time of making the final measurements.

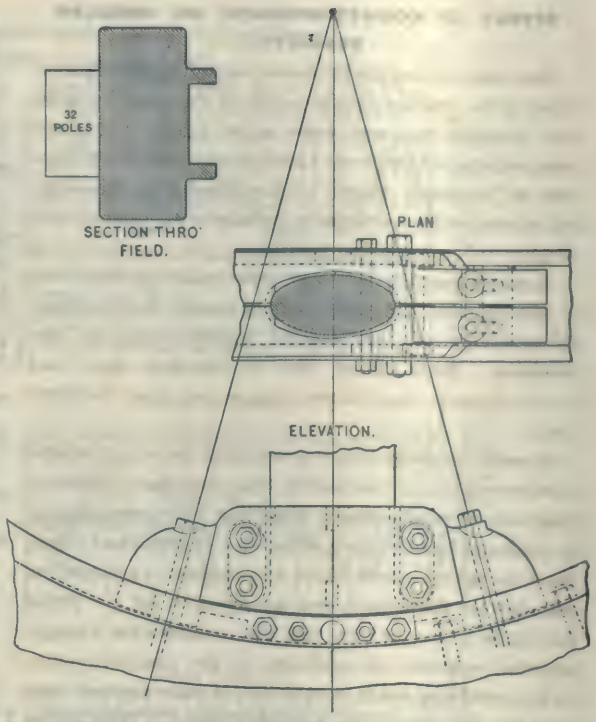


FIG. 4.

VIBRATION OF FOUNDATIONS AND OF SWITCHBOARD PLATFORM.
The width of the diagram measured from one tooth or wave to the bottom of the one next following represents the amount of vibration.

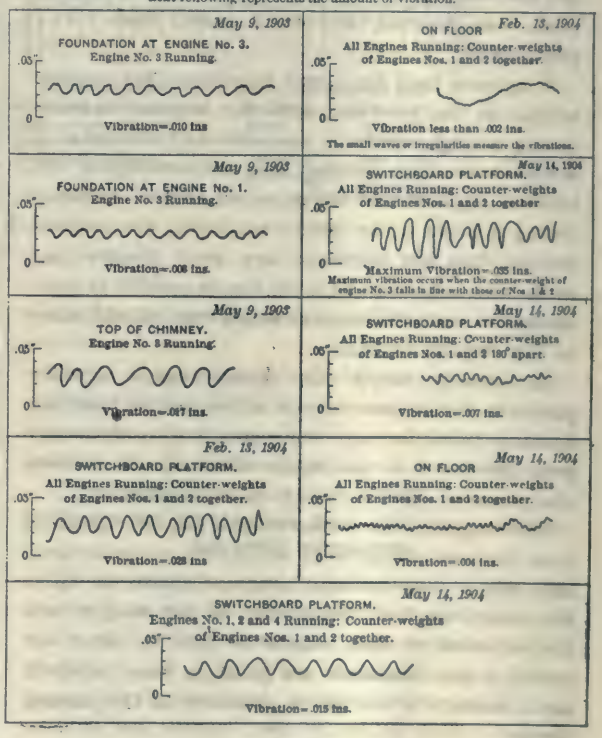


FIG. 6.

EFFECT OF COUNTERWEIGHTS ON ANGULAR VELOCITY.

On a joint visit of the Professor and the writer observations of the angular displacement of the rotating fields and electrical readings were again taken, and these observations led Professor Ganz to conclude that there was no apparent danger of the alternators breaking out of step while operating in parallel with the counterweights in any relative position.

Careful measurements were also made at this time of the amount that the engines shook the building. Observations of the angular displacement of the revolving fields when run in parallel bore out in a general way those made on my previous visit.

In order to study more thoroughly the effect of the counterweights in increasing the angular variation, diagrams of crank efforts were laid off corresponding to indicator cards taken from the engines and from these curves of crank effort the angular variation in pole-degrees was determined, as shown in fig. 5. From this figure it may be seen that the variation for a single machine, without the addition of the counterweights in the revolving fields, would be 1·8 pole-degrees, and with the counterweights 3·2-poled-egrees. The latter value is the one to be compared with the variations observed by looking through one of the revolving fields and observing the other, and it agrees with the amount which was observed, and which varied from 3 to 4 pole-degrees.

It appears from fig. 5 that by placing the counterweights in the revolving fields the angular variation during a single stroke is made about twice what it would have been without the counterweights. It, however, appears that the increased angular variation during a single stroke due to employing the counterweights does not introduce any great disadvantage as the alternators can be safely run in parallel at practically the same efficiency as would exist should there be less angular variation.

As already stated, the counterweights actually placed in the engines were of a less weight than the amounts called for, but not enough to produce any great difference in the results obtained. They were also placed at different radii from those called for.

The weights of the counterweights and their distances from the centre of the shaft which were recommended, and which were actually used, are shown in table. For comparing these the product of the weights into the distances of their centres of gravity from the centre of the crankshaft are given, as these products are a measure of the effects produced on the shaking forces.

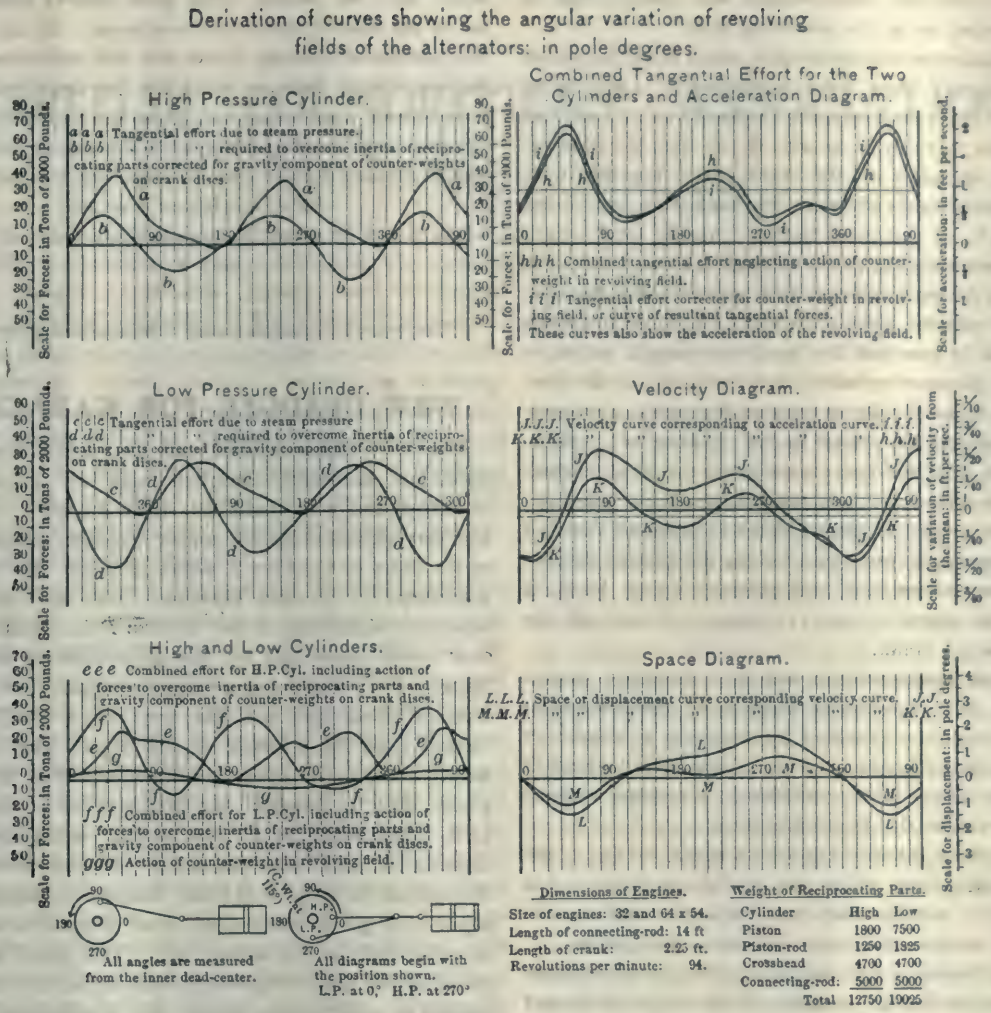
	Recommended.	Actually used.
Engines Nos. 1 and 2 driving alternating current generators:		
Counterweights placed on crank disks	4,995	4,100 lb.
Counterweights placed in revolving fields	3,600	3,467 "
Distance of centre of gravity of the weight in the revolving fields to the centre of the shaft	7 67	7.56 ft.
Distance of centre of gravity of the weights on the crank disks to the centre of the shaft	2.38	2.77 "
Product of weight in tons by the distance in ft. — Crank disks counterweights	5 94	5.68 "
Product of weight in tons by the distance in ft. — Revolving field counterweights	13.81	13.11 "
Engine No. 3 driving direct current generator:		
Counterweight placed on crank disk of high-pressure cylinder	4,995	4,100 lb.
Counterweight placed on crank disk of low-pressure cylinder	4,995	4,180 "
Counterweight placed in fly-wheel	3,600	3,600 "
Distance of centre of gravity of weight in the fly-wheel to the centre of the shaft	7.67	7.06 "
Distance of centre of gravity of the weights on the crank disks to the centre of the shaft	2 38	2.77 "
Product of weight in tons by the distance in ft. — Crank disk counterweights (high-pres. cyl.)	5.94	5.68
Product of weight in tons by the distance in ft. — Crank disk counterweights (low-pres. cylinder)	5.94	5.79
Product of weight in tons by the distance in ft. — Fly-wheel counterweights	13.80	12.71
Weight of original counterweights on crank disks of all the engines	....	1,740 lb.
Distance of centre of gravity of the original counter weights from the centre of the shaft	....	2.05 ft.

CHARACTERISTIC RECORDS.

Fig. 6 shows characteristic records taken with the special instrument for measuring the amount of shake. The principle on which this instrument was constructed is shown in fig. 7 (p. 311). A light pointer A was made to rest against a large mass suspended from a point at some distance above. In most of the experiments this mass was the lower block of the hoist of a travelling crane.

This large mass was not affected by the variations of the building, or if affected its variations had a different period from those to be measured. The instrument was mounted at a part of the building where the vibration was to be measured, and therefore moved in the same way as the building. In taking a record the drum *B* was revolved by hand by pulling the cord *C*, and a curve was traced by a pen *D* on a paper placed on the drum *B*. The width of the diagram placed by the pen represented the amount of vibration. In the diagrams the vibrations were magnified fifteen times. The fact that the cylinder was rotated by hand accounts for some of the irregularities in the curves, but this does not affect the accuracy of the records which depend only on the width of the waves measured from the top of one to the bottom of the one next following.

It may be seen from this plate that the amount of vibration was greater at the time of the last visit than it was when measured on February 13th. This is accounted for by the fact that the ground about the building was frozen on February 13th, whereas such was not the case when the final measurements were made. The final measurements gave 0·035 in. for the



Dimensions of Engines.

Size of engines:	32 and 64 x 54.
Length of connecting-rod:	14 ft
Length of crank:	2.25 ft.
Revolutions per minute:	94.

Weight of Reciprocating Parts.

	High	Low
Cylinder	1800	7500
Piston	1250	1925
Crosshead	4700	4700
Connecting-rod:	5000	5000
Total	12750	19025

FIG. 5.

maximum vibration of the switchboard platform with all the engines running, and with the counterweights of engines Nos. 1 and 2 together. The movement of the floor of the engine room and of the foundation for this set of conditions was 0·004 in. The amount that the foundation shook with the No. 3 engine running alone without counterweights, as measured on the first visit, was 0·01 in. It therefore follows that there was less than one-half the amount of vibration with all three engines running with their counterweights in such a position that they gave the maximum shake than there was with a single engine running without the additional counterweights.

After the above investigation was completed Mr. Bushnell made observations with a transit to determine whether there was any shaking of the chimney with all the engines running, and found that there was no perceptible motion.

The method of computing the size of the counterweights, and the angular displacement of the revolving fields of the alternating current generators when run in parallel, is given in the appendix which follows.

METHOD OF COMPUTING THE SIZE OF COUNTERWEIGHTS REQUIRED.

To most nearly balance the horizontal shaking forces in one of the engines a counterweight equivalent to the entire mass of the reciprocating parts with its centre of gravity at the crank radius should be used. It was impossible to place such a mass on the crank disc, and, as has already been stated, as heavy counterweights as possible were placed on the crank discs,

and an additional counterweight was placed either in the flywheel or in the revolving field.

The maximum counterweights which could be placed on the crank discs were estimated at 4,995 lb. at 2·38 ft. The counterweights originally on the engines amounted to 1,740 lb. at 2·05 ft., so that the counterweights originally on the crank discs, together with the counterweights added to the crank discs, amounted to 6,870 lb. at the crank radius. As the total weight of the reciprocating parts amounted to 12,750 lb. for the high-pressure cylinder and 19,025 lb. for the low-pressure cylinder, there remained 5,880 lb. at the crank radius to be provided for by counterweight action in the high-pressure cylinder, and 12,155 lb. at the low-pressure cylinder. To accomplish this action a counterweight should be placed in the flywheel of 3,960 lb. at 7·67 ft. from the shaft centre. For the direct current generator, where the low-pressure crank leads, this counterweight should be placed about 155 degrees ahead of the low-pressure crank, and for the alternating current generators, where the high-pressure crank leads, it should be placed about 115 degrees ahead of the high-pressure crank.

The full counterweight was not, however, recommended, as a substantial balance of the horizontal forces would be obtained by applying a weight of 3,600 lb. in the flywheels or revolving fields instead of 4,000 lb., and it was considered advisable to keep slightly within the theoretical limit.

In plotting the shaking forces given in fig. 1 the gravity component of the rod at the crank-pin end is assumed to revolve with the crank-pin, and the remainder to have the same motion as the piston.

As the distance of the centre of gravity of the rod from the crank-pin was 46 per cent. of the length of the rod this gave 2,700 lb. for the revolving part at the crank-pin, and 2,300 lb. for the part which was assumed to move with the piston. This gives correct results as far as the shaking forces are concerned. In obtaining the horizontal shaking forces for the counterweights the centrifugal force is multiplied by cos θ where θ is the crank angle measured from the line of centres. For the mass moving along with the piston the horizontal shaking forces were obtained by the formula :

$$F2 = mr2R\ (\cos\theta + Z),$$

where Z can be given the approximate value of

$$\frac{\cos 2\theta}{n}$$

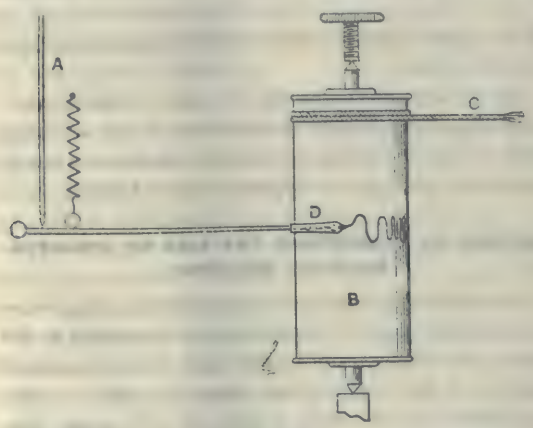


FIG 7. SPECIAL INSTRUMENT FOR MEASURING AMOUNT OF SHAKE.

Read before the American Society of Mechanical Engineers.

NEW DREDGER FOR KARACHI.

Messrs. William Simons and Co., Ltd., Renfrew, have just launched, complete with all machinery on board, and with steam up, ready for work, a large and very powerful bucket hopper dredger, constructed to the order of the Port Trustees, Karachi, for the improvement of Karachi Harbour. The new dredger, which is a sister ship to the *William Price*, constructed over seven years ago by the same builders for the Karachi Port Trust, has a hopper capacity for 1,250 tons of dredgings, and has been built to Lloyd's highest class for a vessel of this type. The bucket ladder constructed upon the most improved form of girder work is designed for dredging to a depth of 45 ft. below water level. The normal bucket dredging capacity is 1,200 tons per hour. All the woodwork throughout the vessel is of teak. Ample accommodation is provided for the officers and crew, in separate cabins, on either side of the ladder well. The vessel is propelled by two sets of triple-expansion surface condensing engines of most modern design, and of sufficient power to obtain a speed of 10 knots per hour. Either set of engines can be employed for dredging, and change-gear is provided so that the full power of the engines can be exerted, whether the vessel is working on hard or soft ground. Steam is supplied from two large multitubular boilers, constructed to Lloyd's rules, for a working pressure of 160 lb. per square inch. Independent steam winches are provided at bow and at stern, for manœuvring the vessel when at work, and independent steam hoisting gear is fitted for controlling the bucket ladder. The hopper doors and side shoots are also manipulated by independent engines. The dredger has been constructed under the direction of Mr. Edward Jackson, M.Inst.C.E., engineer to the Karachi Port Trust, and Mr. D. Morris, M.Inst.C.E., Ammanford, South Wales, the Trustees' home representative, assisted by Mr. E. C. Carey, Uddingston, resident inspector.

BRITISH FOUNDRYMENS' ASSOCIATION.

THE Convention of this Association was held in Glasgow on Monday, Tuesday, and Wednesday last under the presidency of Mr. Robert Buchanan.

The programme of the Convention, in addition to the presidential address, included papers by Professor Sexton, F.I.C., F.C.S., on "Technical Education and the Foundry"; by Mr. Herbert Pilkington, on "Cast Iron"; by Mr. Percy Longmuir, on "Moulding Sands and Fire Clays"; by Mr. A. Campion, on "The Microscope and CastIron," and by Mr. John G. Stewart, on "Profitable Founding."

The President in his address said that the Association existed for the consideration of practical and scientific questions pertaining to the industry—solely for the benefit of those engaged in it. There was a deep and unreasoning belief, or, rather, prejudice, that no improvement or advance or success in methods of manufacture could come from anyone not directly engaged in the business. When to that they added the fact that most practical men had a contempt for, or an unbelief in the utility of, any written or printed word, one began to have some idea of the work they had before them. He spoke of the importance of moulders having a sufficient supply of tools. Insufficient tools were too often found in big foundries, some of them belonging to limited liability companies, presumably wealthy. Owners should go through the foundries themselves occasionally to see that there was a proper supply of tools.

TECHNICAL EDUCATION AND THE FOUNDRY.

Professor Sexton, Glasgow, read a paper on technical education in relation to the foundry. He said that his views on technical education were somewhat heterodox. The confusion which had arisen had largely been due to the fact that each one had looked at the subject from his own standpoint, oblivious of the fact that what suited one industry would not suit another. Generally, with foundrymen as with others, the only technical education possible was that which could be obtained in evening classes, whilst the student devoted his days to actual work at his trade, and in many cases this was after all the most satisfactory form which technical education could take. In the training of those who could give their days to study, the United States and Germany were perhaps ahead of this country, but in the provision for the technical education of those who were actually in daily work this country was unrivalled, thanks very largely to the work of its Science and Art Department. In no case could technical education supersede actual practical training in the shop. All it could do was to give such training as to enable a man to make the very best of the practical training he got in the shop and to understand intelligently the work he had to do. Foundry work was making rapid advances, and yet in many ways it was behind some of the other branches of engineering industry. The reasons were several—the neglect of technical training, the small scale on which the work was carried on in many establishments, and the secrecy which had been maintained as to methods, so that each man had had to work out his plans without the help of others in the same industry, which always led to waste of time and energy, and prevented industrial development. Supposing that a foundryman was anxious to acquire technical knowledge, the subjects of course, would depend much on his preliminary education. The subjects would fall into two groups—those branches of science of which a knowledge was necessary and the actual technical knowledge which was the object to be attained. He sketched a course of study which should take about four sessions, attendances being given on two evenings each week, two sessions being devoted to the preliminary and two to the technical subjects.

The sudden death is announced at Rondebosch, near Cape Town, of Mr. John Brown, C.M.G., late engineer-in-chief of the Cape Government Railways. The deceased gentleman had been connected with the railway administration of the colony since 1873.

Mr. S. Jessop Robinson, of William Jessop and Sons, Ltd., is the future Master Cutler of Sheffield. Mr. Robinson is vice-president of the Jessop Steel Company, of America, a subsidiary company of William Jessop and Sons, Ltd., a member of the Institution of Mechanical Engineers, and of the Iron and Steel Institute; a director of the Lancashire, Derbyshire, and East Coast Railway, and of J. J. Savile and Co., Ltd., Sheffield.

THE IMPROVED ELECTRIC MICROMETER.

By P. E. Shaw, B.A., D.Sc.

THE work done since 1900 has established the reliability of this method of measurement, and seems to show that the limit to its practical sensitiveness (a unit of 4 × 10·8 cm.) has been attained. It may be well, therefore, now to state indetail the form, peculiarities and limitations of the apparatus.

In the drawings fig. 1 is a side elevation of the micrometer and electric circuit; fig. 2 is an elevation, enlarged, showing details of the levers; fig. 3 is a cross section on the line A′ A′, fig. 2; fig. 4 on the line B′ B′ fig. 2; fig. 5 is a section showing the contacts P, Q; fig. 6 is a diagrammatic view of the instrument and suspension.

THE APPARATUS DESCRIBED.

In fig. 1 are shown six levers of steel A fitted to turn on fulcra B, the long arm of one lever being actuated by the short arm of the next through pointed pin C. The fulcra blocks D, which are of hardened steel and have a true surface, are attached to the massive girder I of cast iron, and are surrounded by a metal casing E (fig. 2), which forms the sides of a bath for oil. The fulcra are 1 in. wide, and rest only on two small knife-edges which are at the sides of the fulcra, as shown in fig. 4. The knife-edges are of hardened steel.

The short end of the levers are fitted with a hardened steel plate G (fig. 3), and with a metal casing H, which forms the sides of a bath for oil. The pin C in the long end of the levers (except the first) is fixed by a nut, and the ends of the levers are provided with three holes for these pins so that leverage can be varied (see fig. 2).

The levers are also fitted with pointers J, and the girder has index plates K by which the position of each lever can be fixed, or a template can be used between J and D for the same purpose. Each lever is also provided with a weight L, which gives firm pressure of the levers on the blocks and on one another. The end of the long arm of the first lever is in contact by a polished agate plate with the point of the micrometer screw M, which has twenty threads to 1 cm., and whose nut is attached to the girder. The usual free nut and spring is used to reduce back-lash.

The lower end of the screw has a divided wheel N and a pulley O. The angular movement of the screw can be ascertained by watching in the telescope (fig. 6) the reflection in the mirror *m*, the undergraduated face of N. The end of the last lever is fitted with a spherically ended pin P (fig. 5) of iridio-platinum.

The fixed measuring surface Q is carried by a spindle R from a plate F above, the position of which can be adjusted in the frame F by the adjusting tripod screws shown at the side, and by the binding screw BS at the top. The whole frame and its attached parts are firmly fixed to the girder.

The instrument is enclosed in a felt-covered box, and is suspended by rubber springs from the top of a massive frame S, which itself rests on a pile of heavy concrete slabs T (2 ft. square), with rubber cushions U at intervals. The tension of the springs may be adjusted by weights W, and there are rails CB to prevent these weights falling on the micrometer in case of breakage.

The screw is actuated by an elastic cord driven by a pulley V which is on an independent table. To

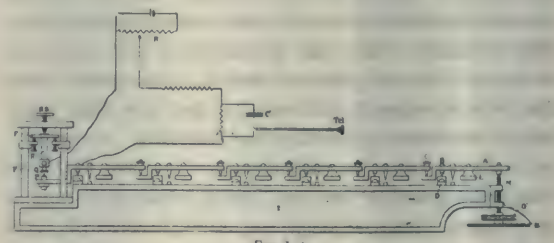


Fig. 1.

SIDE ELEVATION OF MICROMETER AND ELECTRIC CIRCUIT.

reduce the movement set up by the working of the pulley cord, the underside of the box has a plunger W′ working in a dash-pot of castor oil. The vertical movement of the screw actuates the system of levers, the extent of the movement being reduced by each lever in succession, and when the point P touches the fixed surface Q, an electric circuit is completed, and the telephone tel. sounds, as it also does when P and Q separate again.

The circuit shown includes a cell, potential divider R, high resistances telephone, and a condenser C′. As regards dimensions, the height of fig. 6 is 10 ft. and the parts are in proportion. The lever system is 3 ft. long. Each lever is 6 in. long and is made of ¼-in. square bar. The girder is 4 in. deep, and its material is ½-inch thick. The frame F′ is small and massive for the sake of rigidity.

Suppose, as an example, we wish to find the magnetic expansion of the rod R′ (fig. 1), *i.e.*, the amount it changes in length when a known current is sent through a solenoid of which R′ is core.

Remove the plate Q, by unscrewing, and also the last lever which carries P. Polish P and Q with dry rouge on wash leather and finally with clean wash leather. Replace Q and the lever. We have now to make P and Q come just into contact ; this is a very delicate adjustment. Put the telephone tel. to the ear. Adjust the three tripod screws and the binding screw BS on the top of the frame F′ ; the former work up and produce level, while the latter works down. The whole system can be obtained rigid with P and Q just in contact, this contact being shown by the sounding of the telephone.

So far we have obtained only rough contact. To bring P and Q into bare contact, proceed to the pulley V (fig. 6) and wind the pulley cord, turning the screw M until the telephone sounds again.

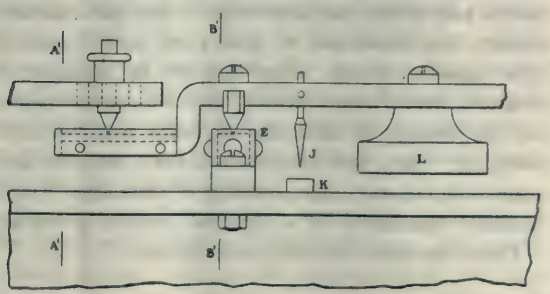


FIG. 2.

ENLARGED ELEVATION SHOWING DETAILS OF THE LEVERS.

This gives the exact position of contact. There will be a steady "creep" of the contact position for a considerable time after the covers have been put in place. Accurate work can be done when temperature

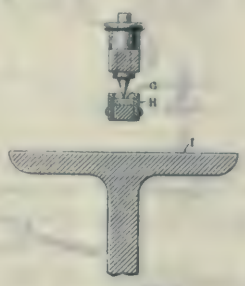


FIG. 3

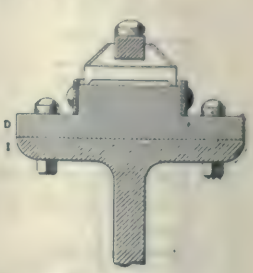


FIG. 4

CROSS SECTION ON LINES A' A' AND B' B' SHOWN IN FIG. 2.

equilibrium is established in, say, 15 minutes. The wheel N is watched and readings on it corresponding to the contact "make" and "break" are noted.

Change the magnetic field on R′ by known amounts and note the corresponding changes in the contact positions of P, Q.

If the joint leverage come to 1000/1 and the screw pitch be 1/20 cm., with 500 graduations on N the unit of the instrument will be 10·7 cm.

The calibration can be done by measuring all the lever arms and multiplying the joint leverage into the unit of the micrometer screw. A better method is to use optical interference.

Take readings of the screw head for every ten rings passing one point and calculate at once the unit.

SOURCES OF ERROR AND PRECAUTIONS.

The levers are bent in order that (*a*) the turning edges of the fulcra, (*b*) the contact point of each lever on the next, (*c*) the contact of screw on the first lever, and (*d*) the contact P and Q where measurements are made, should all lie in one horizontal plane. Thus when the actuating screw works up or down by a small amount there is normal displacement at every contact surface and no scraping of one surface on another. If only these small movements are made we can thus avoid end strain among the levers or actual sliding, which would cause sudden alteration in leverage and jerky working.

The levers conspire to produce minification, each long arm rests on the next short arm and is moved by it. There is no large stress anywhere in the system. The strains are all due to constant gravitation stress.

In actual trial the micrometer is found to work so uniformly that one feels confident that the strains are exceedingly regular, and that each link in the system used does add accuracy as well as sensitiveness.

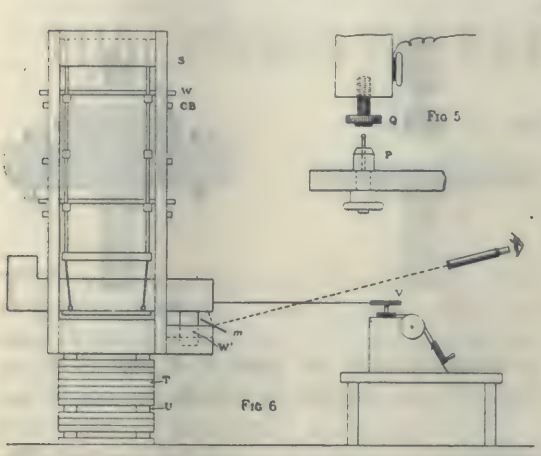


FIG. 5. SECTION SHOWING CONTACTS.

FIG. 6. DIAGRAMMATIC VIEW OF INSTRUMENT AND SUSPENSION.

LONGITUDINAL DISPLACEMENTS.

The levers are allowed three degrees of freedom, a rotation on vertical axis, a translation across the girder, and a translation along the girder. In each case the play is very small. It is very desirable that the levers should have freedom without using it. It is important to have the levers equispaced, for if the small arms have the same length in each lever, a small longitudinal displacement of any lever (except the first and last) will not seriously change the total leverage.

If work of high accuracy is being done, it is necessary to frequently set the levers in those exact places for which the instrument has been calibrated.

The oil baths lessen jerk in case the levers slide, and keep the contacts free from dust and from corrosion by contact with the air. It will be seen that of the thirteen contact places in the lever system only two are exposed to the air, the first and the last.

Tremors from the ground cannot easily reach the micrometer. Measurable tremors only reach the micrometer rarely.

Thermal expansion in the direction of the length of the apparatus can be ignored, whereas expansion perpendicular to the levers would introduce large error.

When a new set of measurements is about to be taken, it is always necessary to uncover the micrometer and clean the contacts P, Q. On putting the cover on again, thermal expansion will be seen in "creeping" of the contact. For the most delicate work, one hour and sometimes more is required for temperature equilibrium to be established.

THE CONTACT SURFACES.

Steel, iron, platinum, copper, carbon, and other surfaces have been tried for P and Q, but iridio-platinum seems best of all, and dry rouge on wash leather is used for polishing. Again, the ordinary use of the surfaces, involving frequent make and break, damages them, say, in one hour of continuous use, and the readings become uncertain.

It has frequently been urged by critics that as the surfaces P, Q approach one another, having a potential difference of, say, 1 volt, there will be a spark between them before the surfaces touch, and that this sparking will be irregular and a source of uncertainty in the finest measurements. This sparking probably always occurs, but it is not irregular within experimental limits, as is shown by the fact that the readings of the instrument are consistent.

As regards the length of this spark-gap, the present writer has made investigations for low voltages, from 100 volts to 0·2 volts, and has found that for P.D. 1 volt the gap is 10 $\mu\mu$, and that the relation between gap and P.D. is linear. Assuming a combination of the linear relation, and taking the P.D. used in the micrometer work, 1/100 volt, the gap would be about 1/10 $\mu\mu$. So that, whether the regular to 20 per cent. or not, the sparking would introduce no measurable error.

APPLICABILITY.

The method has been show to be applicable to various measurements: Telephone diaphragm movements and hence the amplitude of the least audible sound; the expansion of iron, steel, nickel, and of non-magnetic bodies when subject to changes of magnetic field; as a coherer; the two contact points can be brought to molecular distance apart without touching; they then constitute a very sensitive and adjustable coherer; the distance of discharge of two surfaces maintained at a different electric potential.

There are other obvious applications.

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* Abstract of paper communicated to Royal Society by Professor J. H. Poynting.

NOTES ON TECHNICAL EDUCATION.

OUR attention is so freely directed to America in connection with matters affecting technical education that it surprises us sometimes when we learn that American organisers are looking to England for hints and experience. The latest instance of this kind which comes under our notice is connected with technical education in railway school shops. Mr. G. M. Basford, in the course of a paper on this subject read before the American Master Mechanics' Association, finds much to excite admiration and imitation in England. He points out that the London and North-Western Railway has conducted the Crewe Mechanics' Institute at Crewe for fifty-seven years. According to a recent annual report it provides evening instruction for 1,800 students. This road has 1,077 apprentices at Crewe. The students of this school have taken more Whitworth scholarships than the students of any other one institution in England. The Lancashire and Yorkshire Railway controls at Horwich a Railway Mechanics' Institute. In spite of overtime during a busy winter 719 individual students attended classes, as indicated by the latest annual report.

The Great Eastern Railway has 737 apprentices at Stratford, and for fifty-three years has maintained a Mechanics' Institute near the works. The number of apprentices voluntarily attending evening classes last year was 303. In order to encourage further study among its employee-students, the Company, in January, 1904, established apprentice classes during working hours, with elementary educational requirements, those who qualify being allowed to attend without loss of pay. The plan of these day courses is admirable. To encourage higher technical education leave of absence with full pay is granted to employee-students who comply with certain conditions and pass certain examinations.

Mr. Dugald Drummond, locomotive engineer of the London and South-Western Railway, has established a system whereby the apprentices of the Nine Elms works attend day classes at the neighbouring Battersea Polytechnic Institute, the courses of instruction for them being under his control and direction. It is understood that promotion upon the completion of apprenticeship will depend upon proficiency in the school as well as in the shop. This has been recently inaugurated, and promises to be very successful.

In this connection we are reminded by the Railway News of the work done by the Great Western Company at its Signalling Schools. At Paddington the school has been so successful that a model similar to the one in use there has been supplied for use at the Birmingham School, where it is now installed in one of the rooms of the Great Western Hotel recently acquired by the company in connection with the proposed improvements of Snow Hill station.

DEFECTS OF AMERICAN SYSTEM.

That the American systems are by no means so perfect as many of their admirers would have us believe was instanced by a recent article in the Engineering News, of New York, in the course of which the writer took occasion to point out some glaring defects. For instance, it is shown that the elaborate provision made for training draughtsmen can be and is overdone. The only useful purpose served by long practice in this art at college is the greater worth of the new graduate to an employer of draughtsmen. But, if to secure this slight advantage other and more important kinds of training are neglected, the student suffers greatly in the end. In another plan our contemporary remarks that the courses provided, good as they are, are lamentably unbalanced. One year in strains and stresses will impart the necessary principles, but will not make an expert bridge engineer; yet that one year should be enough to train the young engineer so that he can afterward understand the most abstruse of text-books on the subject, if chance makes him a bridge designer. In the same manner the list of subjects might be gone through, showing that the average student spends too much time on many subjects to the exclusion of others of greater relative value, both as a training and as a means of subsequent success. A text-book on law and another on cost-keeping and the management of men should form a part of every student's library.

In the course of his other work the student should be taught how to apply the rules and methods laid down in these books.

In the opinion of the Enginering News, the engineering colleges destined to have the greatest usefulness are those in which the courses in all kinds of engineering shall be essentially the same for, say, the first two years; and that, during this time, the principles underlying all engineering and the principles of business and production generally shall be taught. During the two years that follow, it is probable that differentiations must occur, but still the endeavour should be to train and to form habits rather than to impart dexterity or to cram with facts. The engineering college should not be made a manual training school in any sense; not even drafting or surveying being carried so far as to give any great amount of dexterity. There should, however, be such a variety and such a quantity of manual work in laboratories and in shops as to give a skill of the mind, whether the hand be thoroughly practised or not. Most of the American engineering colleges, it is said, tend to train mathematical engineers, and fail to develop business instincts and habits of thought essential to business success. These remarks by our contemporary are the more significant in view of the fact that in the United States there are 40,000 practising engineers, and no less than 15,000 engineering students.

The reasons for the present improved status of the graduates of engineering schools in the business world at home are discussed by Professor H. H. Norris in a recent issue of the Street Railway Review, and are worthy of careful attention. The most important of these is that by virtue of the mental discipline and training which the schools have given, technical men by sheer force of ability have secured leading places in many important industries. They fill very largely those positions which require the faculty of grasping the elements of new problems, and of facing, without fear, large propositions. Entirely aside from the technical part of their equipment, important as that is, stands the ability to meet men and command respect for their own opinions and conclusions. It is interesting to note that the attitude of the graduate himself towards his business associates is different from what it was some years ago. In many cases he aroused resentment by un unnecessary and unwarranted display of knowledge.

Naturally, the men who had achieved success by hard knocks were not in a state of mind to receive condescension from a young man just out of school and with no practical experience. The trouble in this case was due to the fact that the young man, knowing that he had worked diligently for his information, considered that this equipped him for immediate contact with important practical problems, whereas he really had one of his most important lessons yet to learn. This last lesson was to acquire the ability to adapt what he knew to the conditions under which he was to work. The young man was not seriously at fault, as has been proved by the experience of many employers who draw largely upon college men for their assistants. These gentlemen find that after a year or more of contact with real problems the college man learns to adapt himself to his surroundings, and in the long run surpasses those of his colleagues who lack special college training. The sooner a young man fresh from school realises that he must begin at the bottom of the business ladder and climb for himself, the more rapid will be his ascent and the more useful will he be to his employer.

TESTS ON A 2,000-KILOWATT CURTIS TURBINE.

The following is the report of a test on a 2,000-kilowatt 900 revolutions per minute Curtis turbine (built by the General Electric Company of America). The test was made at Schenectady on May 3rd, 1905, by Mr. F. Sargent, of Sargent and Lundy, engineers, Chicago, and Lewis A. Ferguson, vice-president of the Commonwealth Electric Company.

	Full-load test.	¾-load test.	½-load test.	Zero load.
Duration of test hrs.	1·25	0·916	1·0	1·33
Steam pressure (gauge) lb. ..	166·3	170·2	155·5	154·5
Back pressure (abs.), in. of mercury.....	1·49	1·40	1·45	1·85
Superheat deg. F.	207·0	120·0	204·0	156·0
Load in kilowatts	2023·7	1066·7	555·0	..
Steam consumption per kw. hr.-lbs.	15.02	16·31	18·09	1510·5

On Saturday, July 22nd, the large steel screw steamer *Shedrecht*, built by R. Craggs and Sons, Ltd., Tees dockyard, Middlesbrough, for Mr. Van Ommeren, of Rotterdam, proceeded to sea for her official trials. The results were pronounced entirely satisfactory to all concerned, the vessels registering a speed of between nine and ten knots average in the deep laden condition.

THE DRAINAGE OF THE NEW YORK SUBWAY UNDER THE HARLEM RIVER.

ONE of the important engineering problems encountered in the building of the New York Rapid Transit subway was the construction of the two tunnels, or tubes, under the Harlem river. These two tubes, through which the subway trains are to run regularly from the Lenox Avenue subway continuing to the Bronx subway, were constructed on an entirely new engineering principle, having been built of concrete above ground, and then sunk to the bottom of the river, instead of having been forced through the mud under the river bottom, as has been done in such work heretofore. These twin tubes are 641 ft. in length and are 16 ft. in diameter, the top of the tunnel being 20 ft. below the low-water mark. Before the tubes were put in place the engineering department of the subway contractors devised a system for the drainage of the seepage, or the water percolating through the walls of the tubes and also in case of emergency arising from a sudden inrush of water in the event of the breaking of a water main.

Fig. 1 shows a sectional view of the tunnel looking north-west. The pumps are in position in both of the tubes at the junction of the subway and mouth of the tunnel at Harlem river. Pumps for this service were specially designed and built at the A. S. Cameron Steam Pump Works, foot of East Twenty-third Street, New York. Figs. 2 and 3 are reproductions of photographic views taken in the tubes, and show the inside construction of the tunnel with pumps in position. In the first of these two views a portion of the end of the concrete archway is shown, and it is at this point where the two tubes are joined, the double tracks continuing in one tunnel.

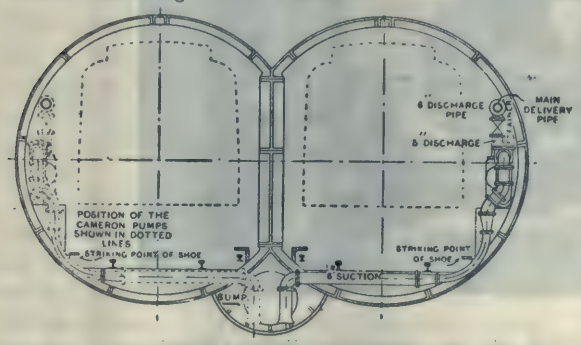


FIG. 1. SECTIONAL VIEW OF TUNNEL LOOKING NORTH WEST.

Fig. 2 shows two of the pumps in position on concrete foundations, with the arrangement of piping and connections. Four of these pumps were installed, being of 12 in. × 12 in. × 18 in. size, and are of the Simplex single-cylinder pattern, having the Cameron regular pattern steam end, which is equaly efficient with compressed air or with steam, the motive power for these pumps being compressed air. Each of these pumps has its separate air lines to the compressor plant, which is situated over three-quarters of a mile away above ground. The pumps are controlled automatically by separate floats located in the tunnel. The automatic float for one of the pumps is along the wall; the other pump, in the distance, has its automatic float nearer the floor and attached to the pump. The air reservoir, 16 in. in diameter by 36 in. long, is arranged in the air pipe line at the throttle of each pipe. The suction piping is also shown extending into the pump, the top of which is protected by iron gratings.

CONSTRUCTION OF PUMPS.

Fig. 3 defines more clearly the outside construction of the pumps, the distinctive feature of which is the construction of the water cylinders, which necessarily are very compact, owing to the limited space allotted to them, the extreme width being only 19 in.; nevertheless, they have ample water valve area. The water valves are set in removable valve decks, allowing them to be easily removed with minimum time cost. The suction valves are placed under the water cylinder, and the discharge valves are shown above the water cylinder.

Each of the pumps is separately and independently connected, and is also designed with the suction and delivery flanges looking fore and aft, permitting the arrangement of the suction pipes as shown, with the pipes running under the "air end," and the foot under the air end made in two parts, straddling the 6-in. suction pipe, permitting the piping to be readily removed. Each of these pumps is capable of delivering 600 gallons of water per minute while running at a normal speed, with an air pressure at the throttle of about 70 lb. per square inch, and a total lift of 70 ft. The capacity could be increased to 1,000 gallons per minute in case of emergency.

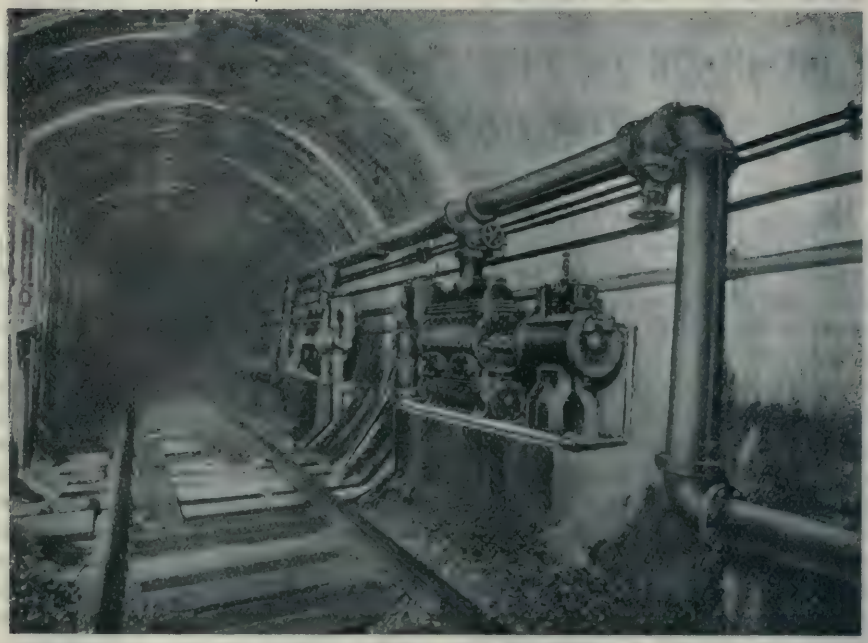


FIG. 2. SHOWING TWO OF THE PUMPS IN POSITION ON CONCRETE FOUNDATIONS.

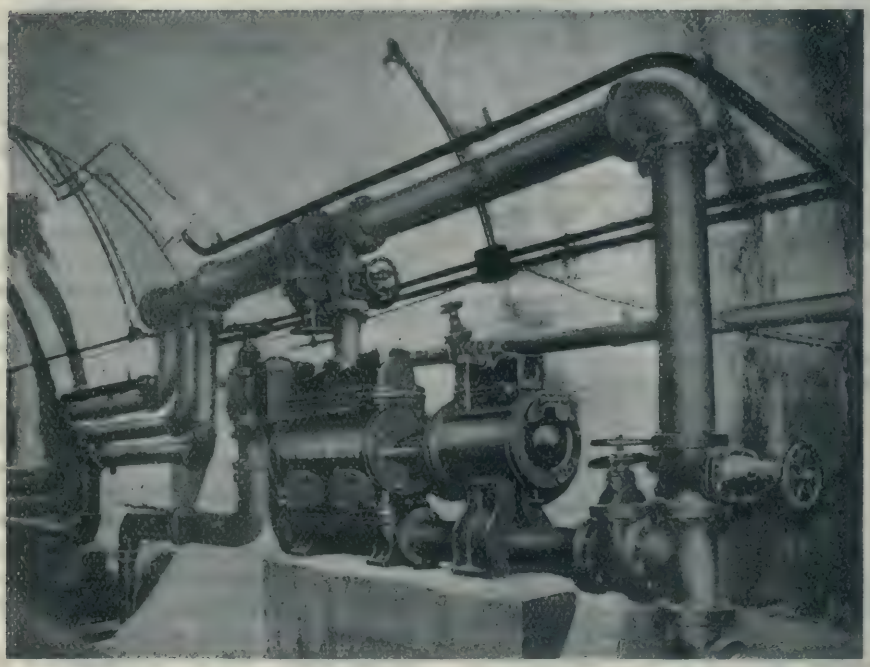


FIG. 3. ANOTHER VIEW OF PUMPS, SHOWING WATER CYLINDERS MORE CLEARLY.

The valve chambers are so constructed as to permit of easy access for inspection and necessary repairs. The water piston and rods are of composition, and, owing to the liability of the water becoming dirty and very gritty, the water cylinders are constructed with removable composition metal bushings. The suction pipes of the pumps are supplied with Cameron strainers of the gooseneck pattern, to keep out the dirt and rubbish and to insure the priming of the pumps by keeping the suction chambers filled with water; thus the cylinders will be flooded with water at all times, permitting the pumps to be started up at any time by the automatic floats. In the event of the water rising, each of the pumps would immediately start pumping as soon as the water would reach the float level.

The Railway and Engineering Review, to which we are indebted for the above details, states that these pumps have already been well tested, owing to the discovery of water in the tunnel some time ago, when temporary piping and connections were hurriedly made and the pumps were pressed into use at short notice, being in operation day and night, and performing good service. The inflow of water was entirely taken care of, and caused but a slight interruption in the completion of the work.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS.

The annual general meeting of the members of the North of England Institute of Mining and Mechanical Engineers was held in the Wood Memorial Hall, Newcastle, on Saturday last. Mr. T. W. Benson (president) in the chair.

ANNUAL REPORT.

The annual report contained an expression of the sense of the deep loss sustained by the Institute by the death of Sir Lowthian Bell, a past-President and a member since 1852. There were now 1,352 members of the Institute, and the library contained 10,510 volumes.

The financial statement showed that the total receipts for the year ending June 30th, 1905, were £2,874 3s. 10d., of which £2,740 16s. was ordinary income. The total expenditure was £2,733 18s., leaving a balance of £140 5s. 10d. This added to the balance with which the year commenced, made £555 19s. 1d. to carry forward.

The chairman then presented a "G. C. Greenwell" bronze medal to Mr. H. W. G. Halbaum for his paper on the action, influence and control of the roof in "long wall" working.

On the motion of Mr. J. B. Simpson, seconded by Mr. Thomas Douglas, a vote of thanks was accorded the president for his services during the past year, and the representatives of the Institute, on the Council of the Institution of Mining Engineers were paid a similar compliment.

The election of officers for the ensuing year resulted as follows: President, Mr. T. W. Benson; vice-presidents, Messrs. Frank Coulson, T. E. Forster, T. Y. Greener, J. H. Merivale, Henry Palmer, and Henry Parrington. Council: Messrs. R. S. Anderson, C. S. Carns, W. C. Carr, M. H. Douglas, Benjamin Dodd, T. E. Jobling, Austin Kirkup, Henry Lawrence, C. C. Leach, Henry Louis, W. C. Mountain, J. H. Nicholson, F. R. Simpson, John Simpson, R. F. Spence, Simon Tate, and R. L. Weeks.

ELECTRICAL RESISTANCE OF COAL AND ORES.

A paper on the determination of the specific electrical resistance of coal, ore, etc., written by G. C. Wood, B.Sc., with a preface by Professor Stroud was read. The paper was the result of certain experiments made by Mr. Wood, who is a Durham County scholar of the Armstrong College, at the request of the Council of the Institute. In the course of the paper it was stated that the specific electrical resistance of coal, for the cases examined, was in comparison with the layers above and below the coal exceedingly high; in fact, so high that coal might be regarded as a very fair insulator. Mr. Wood had recently been determining the specific resistance of a carboniferous limestone from the Barton quarries, near Darlington. This limestone had been found very suitable as ballast on electric railways employing a live rail. The substitution of this limestone for the coke breeze at first used on the electric lines of the North-Eastern Railway Company had, the writer understood, practically prevented any danger to the persons coming into accidental contact with the live rail, provided that there was not a simultaneous contact with the earthed running rail. The experiments showed that coal, and especially hard steam coal, had a comparatively high electrical resistance.

In the course of the discussion it was stated that the manager of the Barton quarries was prepared to sit on a live rail with his feet on Barton limestone.

A paper on "A Mechanical Coal Cutter in Queensland," contributed by William Fryar, was also read.

OPENINGS FOR TRADE ABROAD.

Switzerland.

A concession has been granted for the construction of a narrow-gauge electric railway between Heiligkreuz and Wittenbach. The cost of the work including the laying down of the line, installation of electricity, purchase of rolling stock, etc., is estimated at about £13,200.

Johannesburg.

The Town Council lately adopted the recommendation of their Tramways and Lighting Committee, that the tender of Messrs. Jowett and Raney for the construction of the main street subway, at a cost of £9,781, be accepted. The cost of the subway, which was entirely for tramway purposes, would be defrayed out of the tramway appropriation.

Delagoa Bay.

Work both on the Gorjao Wharf and the new lighter dock is making steady progress, and probably by the end of the year the dock will be completed. At a meeting of the Delagoa Bay Harbour Commission, a discussion ensued on the question of preparing a general scheme of harbour improvements, and it was decided to create a sub-commission specially charged to consider all questions of vital importance to the port.

Pretoria.

The mayor of Pretoria, speaking at a recent meeting of the Master Builders' Association, said that the municipality was about to enter on large public works, including surface drainage and permanent water schemes, plans for which were complete, and they were only waiting the completion of the electric tram scheme prior to raising a loan of £1,000,000 to carry out the schemes and pay off the Government's indebtedness of £200,000.

Germany.

In his recent report, H.M. Consul at Dantzig writes: With regard to immediate openings for British trade, I am still of opinion that a good deal more could be done to push the sale of agricultural machinery. It is also probably a mere question of time when a demand will spring up for motor-cars and other kinds of automobile vehicles. At present the local interest in such matters and the knowledge concerning them is decidedly behind the times, and the inferior condition of the country by-roads may be another drawback to any immediate development in the direction suggested.

Egypt.

Tenders, which will be opened on October 10th are invited for the construction of quays and jetties on the Gabbary shore at Mex. Drawings and specifications may be inspected at the office of the Chief Harbour Engineer, Alexandria. Tenders, in sealed envelopes, addressed to "M. le Directeur Général des Ports et Phares, à l'Arsenal, Alexandria," and inscribed "Offre pour la construction de quais et jetées sur la côte de Gabbary au Mex," should be delivered not later than noon on October 10th. Tenders submitted by persons who have not previously carried out works of this nature will not be accepted.

Holland.

The Commercial Intelligence branch of the Board of Trade have been notified by H. M. Consul at Amsterdam that tenders will be received up to August 16th by the Netherlands Ministry of Commerce and Industry for the supply of the following material: (Contract Surinam VIII.) 40 axles with spoke wheels for carriages and wagons; (IX.) supporting springs for wagons; (X.) cast-iron supporting pots, with appurtenances for carriages and wagons; (Contract lit. W. 11) beam, canal, and "zorés" iron. Further particulars may be obtained from Mr. Mart Nijhoff, bookseller, The Hague, on payment of 1s. 8d. per contract.

India.

The Municipal Board of Mussoorie is prepared to receive tenders for supply, delivery, and erection at sites, in complete working order, of the following plant: (a) steel power pipes; (b) water motors; (c) alternators, with exciters; (d) switchboards, with instruments and apparatus; (e) transformers; (f) induction motors; (g) pumps; (h) workshop machines. Also for the supply and delivery of the following: (a) bare copper wire for overhead mains; (b) insulators and lightning arresters; (c) arc and incandescent lamps; (d) telephone equipment; (e) workshop tools; (f) general stores. Specifications, forms of tender, and general conditions can be obtained on application to Mr. C. H. Shanan, A.M.Inst.C.E., municipal electrica engineer, Municipal Office, Mussoorie, India (telegraphic address, Shanan, Mussoorie), on payment of a deposit of £5, which amount will be returned on receipt of a *bona fide* tender. Sealed tenders, on the prescribed form, endorsed "Tender for Electric Lighting and Waterworks Scheme," should be addressed to the Chairman, Municipal Board, Mussoorie, India, and must be delivered to him by October 23rd. The Municipality will not consider any tender that is not for the whole of the plant or material.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts

CONTRACTS OPEN.

Last Day.

Appleby (Lincs.). — Construction of a concrete and steel service reservoir in the parish of Appleby in the county of Lincoln for the Brumby and Frodingham Urban District Council. Mr. Alfred Atkinson, C.E., Brigg ... ... Aug. 14

Carlisle.—Construction of a storage reservoir, etc., to contain about 180 million gallons, on the Castle Carrock Beck, about nine miles from Carlisle, for the Carlisle Corporation. Messrs. James Mansergh and Sons, 5, Victoria Street, Westminsfer ... ... Aug. 14

London.—The supply and delivery of (1) steel flat-footed rails and fishplates; (2) built-up crosses and switches; (3) Portland cement, for the East Indian Railway Company, as per specification to be seen at the Company's offices. Tenders, marked "Tender for Flat-footed Rails and Fishplates," to be sent to Mr. C. W. Young, secretary, Nicholas Lane, London, E.C.... Aug. 16

Maryport.—Tender for a new centre-ladder, barge-loading bucket dredger complete, delivered at Maryport, for the Maryport Harbour Commissioners, to Mr. F. Kelly, clerk of the Commissioners, Harbour Office, Maryport ... ... Aug. 18

Pembroke.—Supply of two suction gas plants and for the necessary alterations to the present engines to make them suitable for use with producer gas; also supplying new engines and offers for the existing ones. Mr. R. D. Lowless, Town Clerk's office, Pembroke ... ... Aug. 19

Merthyr Tydfil.—Erection of refuse destructor plant capable of effectually burning 120 tons of refuse per day, together with all buildings and contingent works connected therewith, for the Merthyr Tydfil Urban District Council. Mr. T. Fletcher Harvey, engineer and surveyor to the Council, Town Hall, Merthyr Tydfil Sept. 1

Wolverhampton.—A vertical triple-expansion pumping engine and other work connected therewith, for the Corporation of Wolverhampton. Mr. E. A. B. Woodward, waterworks engineer, Town Hall, Wolverhampton ... ... Sept. 1

Last Day.

Selby.—Construction, delivery and erection of duplicate pumping machinery, comprising boilers, triple-expansion engines, surface condensers, force pumps, head gear, and borehole pumps, with a capacity equal to raising 32,000 gallons per hour under a head of 310 feet for the Selby Urban District Council. Mr. Percy Griffith, M.I.C.E., 54, Parliament Street, Westminster, S.W. ... ... Aug. 28

Dundalk.—The Dundalk Harbour Commissioners are prepared to entertain applications for supplying a new or second-hand tug, not less than 90 feet long by 18 feet beam; paddle or twin screw; hull of mild steel; if a twin-screw, counters to be well down and broad; one funnel; boiler, mild steel, with pressure of 100 lb.; not less than 60 h.p.; speed not less than 10 knots. Mr. N. Callan, A.M.I.C.E., Harbour Office, Dundalk ... ... Aug. 31

Scarborough.—Construction and erection of a steel bridge over the Scarborough and Whitby railway, of 60 feet span, with masonry abutments and earthwork approaches, at Manor Road, Scarborough, for the North-Eastern Railway Co. Mr. W. J. Cudworth, the company's engineer, at York ... ... Sept. 4

Southampton.—Supplying and fixing at the Corporation Wharf, Chapel, three 18 in. high-pressure direct-acting centrifugal pumping engines, including all suction and delivery pipes, steam and other connections, for the Corporation. Mr. J. A. Crowther, A.M.Inst.C.E., borough engineer, Market Chambers, 123, High Street, Southampton ... ... Sept. 4

Immingham.—Construction of a new dock, having a water area of about 42 acres, together with a lock and entrance from the River Humber, entrance jetties, river embankments, drain diversions, and other contingent works; also for the construction of a double line of railway, about 4½ miles in length, commencing by a junction with the New Holland branch of the Great Central Railway at Ulceby Station, and terminating near the site of the new dock and other railways and sidings surrounding the dock, having an aggregate length of about four miles, for the Humber Commercial Railway and Dock Company. Sir John Wolfe Barry and Partners, 21, Delahay Street, Westminster ... ... Sept. 20

Bristol.—Construction, delivery, erecting in place, testing, and maintenance for 12 months of pumping machinery for the dry dock now in course of construction at Avonmouth, in the port of Bristol, for the Docks Committee. The contract includes steam engines, centrifugal pumps, steam-boilers, and all auxiliary machinery and piping for the complete installation. Mr. W. W. Squire, Cumberland Road, Bristol. Sept. 11

Bishop's Stortford.—The Urban District Council invite tenders for supplying and fixing gas pumping engine, suction gas plant, and sewage pumps at their sewage pumping station. Mr. Thos. Swatheridge, clerk, Council offices, 7, North Street, Bishop's Stortford ... ... Sept. 12

Chelmsford.—The Lighting Committee has been authorised to obtain tenders for lighting the streets and public clock with electricity, gas, or other illuminating power, for three or five years, from March 25th, 1906 ... ... —

COMING CONTRACTS

Evesham.—The Rural District Council have provisionally decided upon a sewerage scheme, designed by Messrs. Willcox and Raikes, at a cost of £1,300.

Woodall Spa.—The Urban District Council have decided to erect gasworks at a cost of about £5,000 to £5,500.

Horsham.—The Local Government Board have sanctioned the borrowing by the Urban District Council of £4,724, £1,120, and £880 for electric lighting purposes, but decline to sanction the borrowing of £400 for free wiring. They have also sanctioned the borrowing of £700 for private street works.

Bridlington.—The Council are applying for sanction to a further loan of £4,500 for electric lighting—viz., £2,000 for connecting up new consumers and small extensions to mains and public lighting, and £2,500 for new generating set.

Cannock.—The Council's application to borrow £13,000 for electric lighting purposes has been granted.

Thrapston.—The Rural District Council have instructed the surveyor to prepare plans for sewerage works at Great Addington, with a view to tenders being invited.

CONTRACTS CLOSED.

Cupar.—The Town Council have let the contract for their extensive septic drainage scheme, which will cost in work and material, exclusive of wayleave and land compensation, about £9,000, to Mr. R. C. Crawford, Uddingston, and the construction is expected to take from nine to twelve months

Malvern.—The tender of Messrs. Tangye, Ltd., Birmingham, for the engines, boilers, and machinery for the new water scheme of the Malvern District Council has been accepted at £3,430. A bonus of £20 per week is to accrue to Messrs. Tangye for every week by which they can anticipate the stipulated date for delivery. Messrs. Meredith Brothers, of Gloucester, are to lay the mains, etc., from the pumping station to the reservoir for £7,339.

Tenbury.—The Worcestershire County Council have instructed Messrs. Cruwys and Hobrough, of Gloucester, to build the Stanford Bridge over the River Tame, having a clear span of 98 feet. We understand that Hennebique's patent ferro-concrete is to be used.

Navy Contract.—Messrs. Joseph Kaye and Sons, Ltd., of Leeds and London, have received an order from H.M. Navy for 4,700 of their new patent serrated seamless oil-feeders.

Derby.—The Council recently voted £256 for completing and fitting up the Market Hall for electric lighting. It was stated that the cost of the installation of intensified incandescent gas was £42 more than the cost of an electrical installation.

Glasgow.—The North British Locomotive Company, Ltd., Glasgow, have secured contracts for 40 locomotives for the Indian State Railways, 44 for the Great Indian Peninsula Railway, and 22 for the South Indian Railway. This concern has also secured a contract for 22 locomotives for the Argentine railways, making 128 altogether.

APPOINTMENTS VACANT.

Edinburgh.—The Water of Leith Purification and Sewerage Commissioners require the services of a civil engineer to devote his whole time to the superintendence of the engineering work involved in the management of their system, and the carrying out of their Acts of Parliament. Salary £200 per annum. Applications to Mr. H. Inglis Lindsay, W.S., 16, Queen Street, Edinburgh ... ... Aug. 21

Derby.—County surveyor at a salary of £500 per annum, rising by annual increments of £25 to £600. No pension. The gentleman appointed will be required to devote the whole of his time to the duties of the office, and will have the entire charge of all roads and bridges under the care and control of the County Council. Particulars of duties, etc., can be obtained from Mr. N. J. Hughes-Hallett, County offices, Derby... ... . Sept. 6

APPOINTMENTS FILLED.

Halifax.—Mr. Murdoch, assistant to Professor Baily in the Heriot-Watt College, has been appointed head of the electrical engineering department in the Municipal Technical School, Halifax.

Hull.—Mr. Edward Watkin, mineral manager of the Great Central Railway, has been appointed general manager of the Hull and Barnsley Railway Company.

Acton.—Mr. H. A. Harding, of the Leatherhead Electricity Supply Co., has been appointed assistant electrical engineer to the Acton Urban District Council.

Salisbury.—Mr. S. Poole, of the Grantham and Stamford electricity works staff, has been appointed assistant engineer at the Salisbury electric light works.

West Bromwich.—Mr. W. A. Jackson has been appointed chief engineer and manager of the West Bromwich Corporation electricity works, at £300 per annum. He is at present under the Manchester Corporation electricity department.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows :—
Consols : Sept. 1st. General Settlements : August 16th, 31st, September 14th. Bank Rate, March 9th, 1905, 2½ per cent

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	1⅜ — 2¼
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4⅜ — 5
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3⅛ — 3⅜
76,970	5	2/-	Do. 4% Cum. Pref.. ..	5	5⅜ — 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 —104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	2/4½	Babcock and Wilcox, Ltd., Ord. ..	1	3⅛ — 3⅜
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1⅜ — 1⅝
20,000	5	8/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4⅜ — 5½
250,000	1	6¾d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1⅛*
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —104
150,000	4½	2/8½	Barrow Hæmatite Steel Co., Ld., O.	4½	1 15/16 — 1 31/32
50,000	4½	8/-	Do. do. Cum 2nd. Pref.	4½	4⅛ — 4⅜
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares ..	5	4¾ — 5¼
£500,000	100	4½%	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red.,Scrip 50% pd	—	103½—105⅝
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾— 12¾*
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	98—100
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	1/16 — 1/8
300,000	1	6¾d.	Do. 5½% Cum Pref.	1	15/16 — 1 1/16
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	94 —97
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	13/16 — 1
1,860,900	1	3⅜d.	Do. Nos. 1,639,101-3,500,000	12/-	½ — 5/8
1,160,000	1	10½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1⅛ — 1¼
590,000	1	1/2	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅛ — 1¼
74,000	10	5/-	Do. 5% Cum. Pref.	10	11⅛—11⅝
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord. ..	5	8¼— 9⅜
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5⅛— 5⅝
450,000	1	1/2⅜	Clayton & Shuttleworth, Ltd., Ord.	1	13/16 — 1
70,000	5	2/6	Do. 5% Cum. Pref.	5	5½ — 5¾
£250,000	Stk	4%	Do. 4% 1st Mort. Db. Stk. Red	100	100 -102
100,000	10	7/6	Consett Iron Co., Ltd., Ord.. ..	7½	32 — 33
57 031	10	10/-	Crossley, Bros., Ld , Ord. 40340/97370	10	15⅞—16
40,339	10	5%	Do. 5% Cum. Pref.	10	11½—11⅞
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2⅛— 2⅜
1,259,594	1	3⅜d.	Dorman, Long & Co., Ltd.	1	17/32 — 19/32
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	88 —92
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	2¾— 3½
250,000	1	9⅜d.	Dunlop (James) & Co., Ltd., Ord...	1	1/2 — 5/8
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	7/8 -1
4,721	13	18/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9½ — 9¾
69,754	13	10/-	Do. do. do.	10	6½— 7
20,250	10	8/-	Elliott's Metal, Ltd.	8	5 — 5⅛
5,000	10	5%	Do. Cum. Pref. 5%	10	8⅝— 9½
186,748	Stk	4%	Do. Deb. 4%	100	90 — 94
25,000	10	6/-	Fairfield Shipbuilding & Engng.Co., Ltd., 6% Cum. Pref. ..	10	11 —11½
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk .Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000..	10½	12½—12⅞
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10⅛
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	3⅝—4⅛
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5⅛ — 6
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	88½—89½
16,800	10	10/-	Greenwood & Batley, Ltd., Ord. ..	10	7 — 7½
9,600	10	7%	Do. 7% Cum. Pref.	10	10 — 10½
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 5/16 — 2 7/16
344,000	5	2/6	Do. 5% Cum. Pref.	5	6⅛ — 6½
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	104⅛—106½
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2 — 3
250,000	1	3/6	Hadfield's Steel Foundry Co., Ld., Ord.	1	3 1/16 — 3 3/16
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½— 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5 — 5½*
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	1 3/16—1 5/16*
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	97— 99
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	4⅜— 5½
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	11/16 — 13/16
18,000	5	3/-	Do. 6% Cum. Pref.	5	4⅜— 5
£100,000	Stk	6%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	98—100

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
750,000	1	7½%	Howard & Bullough, Ltd., Ord. ..	1	1⅝ — 1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12⅝—13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	95 — 98
37,500	10	20	Kynoch, Ltd.	10	17 —17½
49,537	10	5%	Do. Cum. Pref. 5%	10	10½—10¾
300,000	1	4½d.	Lambert Bros., Ltd., Ord.	1	3/32 — 5/32
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref. ..	3	3⅜ — 3¾
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16 — 1 7/16
£300,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk., Red.	100	107 —109
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11⅜—12
210,000	1	8⅜d.	Measures Bros., Ltd., Ord.	1	3/32 — 5/32
75,000	1	6¾d.	Do. 5½% Cum. Pref.	1	3/32 — 5/32
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
21,943	5	2/6	Muntz Metal, Ltd.	5	4⅞— 5⅛
14,248	5	5%	Do. Pref. 5%	5	4⅝— 5⅛
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	79 — 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅜—12⅝
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	88 — 91
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅛— 3⅜
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	6⅛— 6⅜
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	9⅜—10⅛
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock .	100	98 —101
20,000	5	3/-	Peebles(Bruce) & Co.,Ld., 6% Cm.P.	5	5 — 5½
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	6/8 — 7/-
13,000	5	—	Do. 5½% Cum. Pref.	5	4 — 4½
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	1/8 — 1/4
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1¼ — 1⅜*
73,062	5	2/-	Do. New	5	1⅜ — 1½*
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	99—101*
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000 ..	1	31/32 — 1 1/32
£350,000	1	7⅛	Do. 6% Cum. Pref.	1	15/16 — 1
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	93 — 95
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	10 —10½
275.000	1	6d.	Scott (Walter) Ltd., Ord.	1	3/8 — 7/16
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	7/8 — 1
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	92 — 94
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	90 — 93
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	11/16 — 13/16
300,000	1	1/2½	Do. 6% Cum. Pref...	1	1⅜ — 1⅝
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	90 — 93
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	5⅛ — 5⅜
£125,240	Stk	5%	Do. 5% Trust Mort. Deb. ..	100	105—106
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2 — 2½
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	3⅞— 4⅛
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	76— 79
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17½—18⅛
55,000	10	6/-	Do. 6% Cum. Pref.	10	14⅛— 15
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	13/16 — 15/16
538,845	1	6d.	Do. 5% Cum. Pref.	1	15/16 — 1 1/16
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	96 — 99
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	3/16 — 5/16
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	77 — 81
£148,500	1	7½d.	Thornycroft (John I.) & Co., Ltd. Or.	1	5/16 — 7/16
£160,000	1	7½d.	Do. do. 6% Cum. Pref.	1	13/16 — 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½ — 9¾
$508495200	$100	8¾	United States Steel Corp. Com. Stk.	$100	37⅛ — 37⅜
$360314100	$100	$1.75	Do. 7% Cum. Pref. Stock	$100	108⅛—108⅜
$162268000	$1000	5%	Do. 10-60 yr. 5% Skg. Fd. G. Bds.	$1000	99 — 101
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord..	1	2 7/16 — 2 9/16*
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1 5/16 — 1 7/16*
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	119 —122
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	104 —106
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	106 —108
225,000	1	1/2⅜	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	13/16 — 15/16*
500,000	1	7½d.	Do. 6% Cum. Pref. Ord. ..	1	1 1/16 — 1 1/8
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	84 — 87
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5%	5	4¼ — 4⅜
900	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/-	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2⅛ — 3½
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	73 — 78
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	74 —76

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount ubscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝— ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	1/16— 1/16
120,000	1	1/2⅝	Bell's Asbestos Co., Ltd.	1	1—1⅛
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5½— 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½— 6*
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	100—102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 7% Pref. ..	5	2⅜ — 2⅝
£616,358	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	85 — 89
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½— ¾
150,000	2	2/4½	Do. 6% Pref.	2	1¼— 1⅜
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92 — 95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	77 — 80
35,000	5	7/6	Callender's Cable & Constn. Ltd. Ord.	5	10 — 11
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5¼— 5⅜
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	106 —108
85,000	1	1/6	Crompton & Co., Ltd...	3	1½— 2·
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	94—99%
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7⅞— 8¼
61,000	5	3/-	Do. 6% Cum. Pref.	5	5⅞— 6⅛
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	104 —106
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛— 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 —109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	5	1½— 1⅝
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2 — 2⅛
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	83 — 88
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	89 — 94
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	⅜— ⅝
31,390	2	2/9⅜	Do. 7% Cumulative Pref. ..	2	1¾ — 2⅛*
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	93 — 96
10,248	10	7/6	Evered and Co., Ltd.	10	10 — 12
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½— 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk.. Red.	100	97—101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11½—12½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅜— 5⅝
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber. Gutta Percha & Telegraph Works Co., Ltd.,	10	15 — 16
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	—	Parker, Thos., Ltd.	10	6½— 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	31 — 33
£150,000	100	4%	Do. 4% Deb. Bonds	100	101 —103

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅜— 8⅝
260,007	5	2/6	Do. 5% Cum Pf.	5	5½— 6
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	141 —144
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	13⅜— 14⅛
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9½— 10*
£46,300	100	5%	Do. 5% Debs., Red. ..	100	98 —101*
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97 —102
75,696	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	1/16— 1/8*
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	1/16—1⅛
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord...	5	1 — 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	4 — 4½
£425.000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	95 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	106 —109
		5%	Pref. Ord. Stock	100	99 —102
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	8½— 8⅝*
156,487	10	6/-	Do. 6% Cum. Pref.	10	11 —11½
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	121 —123
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	97 — 99
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	8 — 8¼
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5 1/16—5 1/16
27,000	5	3/-	Do. "B" do.	5	5¼— 5¼

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	96 — 98
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	100 —103
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	9 — 9⅛
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 - -108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅛— 1⅛*
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4⅞— 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99 —102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	102 —104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½—14½*
59,987	10	6/-	Do. 6% Pref...	10	15 — 16*
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2½— 3
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	88 — 88
125.000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9½—10
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —101
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	102 —104
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	¼ — ⅜
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 — 1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	104 —106
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½— 1½
110,923	8	3/2⅝	North Metropolitan Tramways Co..	8	4½— 5
£150,000	100	3½%	Do. .. .. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	103 —106
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8⅜— 9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9¾ — 9⅞
£220.000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	101 —104

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11⅜— 12¼
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10— 10½
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11½ — 12¼
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	106 —108
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼— 5⅝
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	103 —106
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10— 10½
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9¾— 10½
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9½
£288.782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	103 —106
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	6⅜— 7⅛
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5¼— 5⅜
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	103 —105
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6 —6½
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 —110
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	10½—11
40,000	10	6/-	Do. 6% Cum. Pref.	10	13 — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	122 —126
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —105
40,000	10	5/-	County of London Elec. Supply Co., Ltd., Ord.	10	8⅝— 9⅛
30,000	10	6/-	Do. 6% Cum. Pref.	10	11½—12⅝
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111 —114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5⅜ — 6⅞
70,000	5	3/-	Do. 6% Cum. Pref.	5	6⅜ — 6⅝
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	105 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	85 — 90
10,000	5	/6	Folkestone Elec. Supply Co., Ld., O.	5	5½ — 5⅝
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	99½	102*
15,000	10	—	Havana Electricity Co., Ltd.... ..	10	9⅜— 10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7⅝— 8¼
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	⅝— ⅞
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	11½—12⅝*

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	1/9⅓	London Elec. Supply Corp., Ld., Ord.	3	1⅞ - 2⅛
60,000	5	3/-	Do. 6% Pref.	5	5 — 5⅛
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 -102
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	9⅛ —10⅛
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅛ — 5⅝
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —113
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	98 —100
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99—101⅛
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14 — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6½ — 7
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13 —14*
20,000	5	3/6	Do. 7% Pref.	5	8⅞ — 9*
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	97 —99
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅜ — 2⅞
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	76 — 80*
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3½ — 4
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅜ — ⅞
50,000	1	8⅜d.	Do. 7% Cum. Pref.	1	1⅛ — 1⅜
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	106 —109
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4⅛ — 4⅞
30,000	5	2/6	Do. 5% Cum Pref.	5*	5⅛ — 5⅜
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104 —106
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½ —12⅝*
28,151	5	2/6	Do. 5% Cum. Pref.	5	6⅛ —6⅜

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	98 —101
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2½ — 3
£768,580	Stk	14/-	Anglo-American Tel. Co.. Ltd., Ord.	100	58 — 60*
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	105 —106*
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	13⅛— 13⅜
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7⅛— 7⅜*
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	——
£1,909,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96½—98½
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8½ — 9
6,000	10	10/-	Do. 10% Preference	10	17 — 18
6,000	5	2/- 5/-	Direct Spanish Telegraph Co., Ord. 10% Cum. Preference	5 5	3⅜— 3⅝ 9 — 9½
£30,000	50	4½%	Do. 4½% Debs...	50	100-103⅝
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	11½—11⅝*
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	39—101
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	99—101*
£300,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101—103⅝
200,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13⅜—14⅛
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	104⅛-106⅛*
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	142 --145
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	89— 91
£1,886,814	Stk	4%	Do. 4% Mort. Deb.	100	107 —109
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	35 —36
£58.700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	99—101
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	51½— 53½
72.680	1	7⅛d.	Monte Video Telephone Co., Ltd., O.	1	⅞— 1
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	107½-108½*
£1,966.667	Stk	5%	Do. Deferred	100	104 —106*
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅜ — 5⅞*
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	99 —101
£689,593	Stk	4%	Do. 4% do. do. ..	100	103—105
179,313	1	8⅜d.	Oriental Telephone & Elec. Co., Ltd.	1	1⅜— 1 5/16
50,000	1	7⅛d.	Do. 6% Cum. Pref.	1	1⅜—1⅝
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	97 —100
11,889	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7⅞ — 8
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7⅛
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛ — 5⅜
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	107⅛—109⅛
15,609	10	5/-	W. African Telegraph Co., Ltd. ..	10	8½ — 9
£30,038	2½	—	West Coast of America, Ltd. ..	2½	1/16 — 1/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	99 —101

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	½ -- ⅝
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8- 8½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	5⅞— 6⅛
£80,000	100	5%	Do. 5% Deb.	100	100 —103
207,930	10	8/-	Western Telegraph Co., Ltd. ..	10	13⅞ —14⅛
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	100 —102
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	102 —104

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8⅞— 9⅛
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	100—102
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	95 — 97
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5⅞— 6⅛
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red.. ..	100	99 —101
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	11⅞— 12⅛
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4⅞— 5⅛
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	100—102
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1½ — 1⅝
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5⅛
36,758	8	4/9⅔	Do. Non-Cum. 6% Pref.	8	7⅞— 8⅛
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —100
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2⅛— 2⅜
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2⅝— 3⅛
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	86 — 88
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	4 — 4½
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	128 —131
£1,160,000	Stk	19%	Do. do. Deferred ..	100	224 —227
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	34½— 35½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4⅜— 5⅛
39,075	5	2/6	Do. "B" Ord...	5	4 — 4⅛
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8½ — 9
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10½— 10⅝
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9⅜d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1⅛— 1⅜
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	126 —131
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	⅛ — ⅜
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	3/16 — ⅜
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ —1⅜
135,000	1	7⅛d.	Do. 6% Cum. Pref. ...	1	1⅛ —1⅜

RAILWAY CARRIAGE & WAGON COMPANIES.

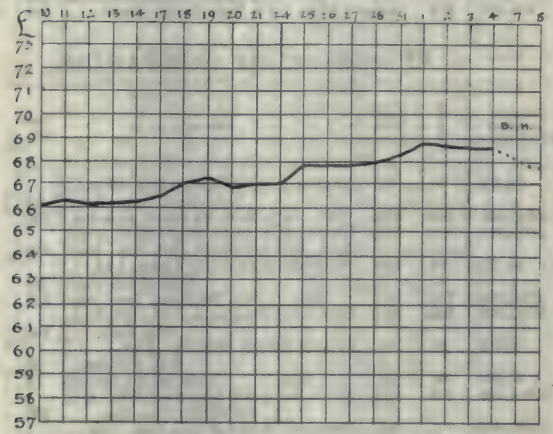
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	22½—23½
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8⅞— 9⅛
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13⅞ —14
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9⅜— 10
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4*— 4½
14,567	10	1/3	Lancashire Wagon, Ord.	2	2⅜ — 2⅝
4,150	10	5%	Do. do.	10	10⅛— 10⅜
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	42/6-43/6
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/9--24/6
235,000	1	7⅛d.	Do. Cum. B Pref. 6% 1-235,000	1	28/6-- 29/6
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 —19½

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JULY 10TH TO AUGUST 8TH, 1905.

COPPER.



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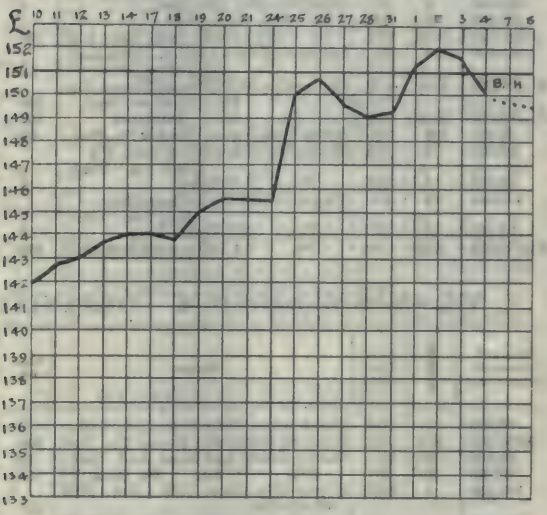

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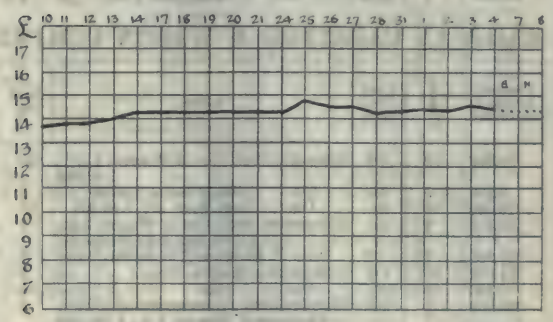

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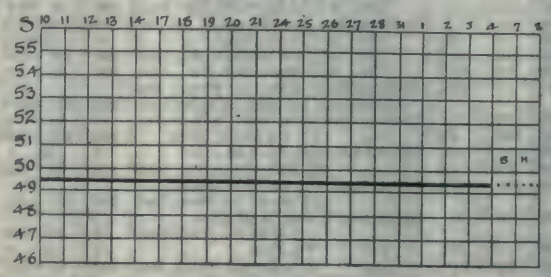

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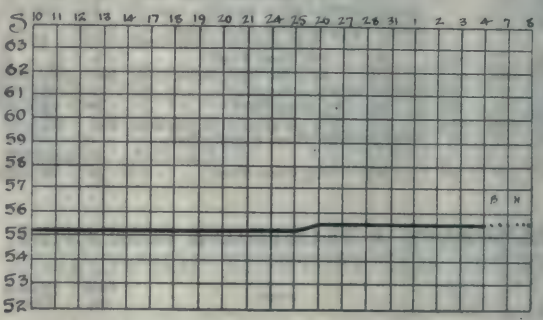

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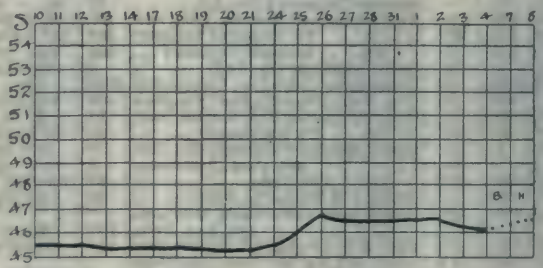
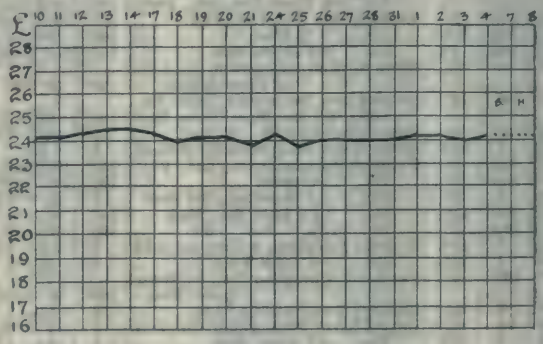


SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, August 9th, 1905.

THE Copper market declined a little from the best values on the eve of the holidays, but with cash delivery quoted at £68 15s., there is still a rise on balance to be recorded, and as a matter of fact the price of refined copper is higher to-day than it was during the rise in 1901. The difference between the position now and then is that four years ago when copper reached a high level, the market was manipulated by American operators who kept a tight grip on a considerable stock of unsold metal. To-day the market is not in the hands of a clique, and there are no surplus stocks of metal, good brands being exceedingly scarce, while the supply of the cheaper qualities is admittedly limited. The price closes £68 15s. cash and £68 18s. 9d. three months.

The Tin market has been characterised by extreme sensitiveness. At one time when the statistics revealed the strong position of the metal bear covering purchases produced a rise to £152 cash, but this figure induced profit taking on the part of weak holders, and the price relapsed to £149 15s. cash and £148 5s. three months. The outlook, however, is favourable for a continuance of the bull campaign, good consumption being likely to coincide with a further restriction of supplies.

Lead has been somewhat unsettled owing to free offerings of the metal made in view of the more plentiful supplies. Demand shows signs of slackening off. The market closed firmer, however; soft foreign spot £14 7s. 6d., August-September shipment £13 7s. 6d.

Some large orders for Spelter have been in the market and the undertone is decidedly firmer. Trading reports are good, particularly from the United States. The final quotations are £23 17s. 6d. to £24 for ordinaries, and £24 12s. 6d. specials.

An easier tendency is to be noted in the iron and steel section, free selling on the part of holders having somewhat checked the speculative demand. Cleveland warrants which had improved to 47s. 1½d. three months close weaker at 46s. 7½d., and standard iron has fallen with warrants. With trade conditions distinctly better in England, and excellent reports coming to hand from America and the Continent, there appears good reason to anticipate a stronger market, notwithstanding the large supplies of Cleveland which are locked up.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:		£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
♛♛	,, ,, ,, Land ,, ,, ...	6	17	6
STEEL	,, Steel Bars, Boiler Quality	6	17	6
DALZELL	Siemens' Steel Plates, Ship Quality Plates.....	5	17	6
♛	,, ,, Bars ,, ,, ...	6	7	6
STEEL	,, ,, Angles.....	5	7	6

Manufactured Iron:				
Bars—Dalzell.....		6	2	6
,,	Best	6	12	6
,,	,, Horseshoe	6	12	6
,,	Angle.....	6	2	6
,,	Best Angle	6	12	6
,,	Best Best	7	2	6
,,	Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

(Glasgow ♛ Steel)	£	s.	d.	
Steel Angles	5	7	6	per ton.
Steel Ship Plates	5	17	6	,,
Steel Bars, Ship Quality	6	7	6	,,
Glasgow ♛ ♛ Steel.				
Steel Bars, Boiler Quality	6	17	6	,,
Steel Land Boiler Plates	6	7	6	,,
Steel Marine Boiler Plates	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B., quote:—

		£	s.	d.
Bars—Phœnix		6	5	0
,,	Best	6	15	0
,,	Best Best	7	5	0
,,	Extra Best.....	7	15	0
,,	Best Horse Shoe	6	15	0
,,	Extra B.H.S.	7	15	0
,,	Extra Best Cable	8	5	0
,,	Rivet	6	5	0
,,	Best Scrap Rivet	7	5	0

	£ s. d.
Angles—Phœnix	6 5 0
,, Best	6 15 0
,, Extra Best	7 5 0
Gas Tube Hoops—Phœnix Best	6 15 0
Plates—Phœnix	—
,, Best Boiler	7 10 0
,, Best Best Boiler	8 0 0
,, Extra Best Boiler	9 0 0
Boiler Tube Strips—Phœnix Best Best	8 0 0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1. £ s. d.	No. 3. £ s. d.
Coltness, f.a.s. Glasgow	3 5 0	2 13 0
Gartsherrie ,,	2 17 0	2 12 0
Summerlee ,,	2 17 0	2 12 0
Carnbroe ,,	2 14 0	2 12 0
Langloan ,,	3 0 0	2 15 0
Calder ,,	2 17 6	—
Clyde ,,	2 16 6	2 11 6
Glengarnock, f.o.b. Ardrossan	2 17 0	2 12 0
Eglinton ,, ,,	2 12 6	2 10 0
Dalmellington, ,, Ayr	—	2 12 0
Shotts ,, Leith	2 17 6	2 12 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£ s. d.
W.W. ♔ Bars	6 12 6
W.W. Best Bars	7 2 6
W.W. Best Best	7 12 6
W.W. Best Best Best	8 2 6
W.W. Best Shoe	7 2 6
Thornaby ♔	8 2 6
Thornaby Best	8 12 6
Thornaby Best Best	9 12 6
Whitwell Special Admiralty Cable	10 5 0
Special Chain Iron	9 5 0
Tube and Nail Strips	6 15 0
W.W. ♔ Angle Iron	6 15 0
W.W. Best Angle Iron	7 5 0
Tee Iron, to 8-inches United	7 12 6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron. £ s. d.	Steel. £ s. d.
♔ (BN)	Bars	6 10 0	6 15 0
	Angles	7 0 0	7 5 0
	Tees	7 10 0	7 15 0
♔ W.I.W	Hoops	7 0 0	7 10 0
	Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets	Singles 20 G 96in. by 36in. per ton. £ s. d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £ s. d.
"Vale"	10 0 0	10 10 0
"Shield"	10 10 0	11 10 0
"Severn"	11 10 0	12 10 0
"Baldwin Wilden B."	12 10 0	13 10 0
Charcoal	16 10 0	17 10 0
Best Charcoal	18 10 0	19 10 0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£ s. d.	£ s. d.
No. 3 Lead	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne	15 0 0	16 0 0
S.V. Terne	16 10 0	17 10 0

Tinned Sheets:	Singles 20 G to 10S by 36in. per ton. £ s. d.	Doubles 21 to 24 G to 96 by 36in. per ton. £ s. d.
Best Coke (Finish)	29 0 0	30 10 0
,, Charcoal (Finish)	31 0 0	32 10 0
Extra ,, ,,	33 0 0	34 10 0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£ s. d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	12 0 0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14 5 0	,,

Galvanized Working Up-Sheets:

	£ s. d.	
24 G., f.o.b. London, in Bundles	13 0 0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£ s. d.	
Crown Bars	6 10 0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7 0 0	,,
Angles	6 15 0	,,
,, Best	7 5 0	,,
T's	7 0 0	,,
,, Best	7 10 0	,,
Best Shoe Iron	8 0 0	,,
,, Rivet Iron	8 0 0	,,
,, Best Rivet (Special)	9 5 0	,,
,, Cable	9 5 0	,,
,, Screwing	8 5 0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

Coke Tin-plates.	Per Box. f.o.b. Wales. £	s.	d.
C 18¾ by 14 124s. 110 lb. "BV"	0	12	4½
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	4½
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	0
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	9

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d	
Blooms	at 3	16	0	per ton.
Billets	at 3	18	0	,,
Sheet Bars	at 4	0	0	,,
Finished Steel:				
Bars	at 5	0	0	per ton.
Angles	at 5	1	0	,,
Tees	at 5	5	0	,,
Joists	at 4	10	0	,,
Fencing Standards	at 5	3	0	,,
Shoeing Bars	at 5	5	0	,,
Tyre Bars	at 5	5	0	,,
Half-Round Bars	at 5	10	0	,,
Heavy Rails	at 5	5	0	,,
Light Rails	at 4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.		
English Ingots, f.o.b. Dis. 1¼% & 1%	150	0	0	to	150	10	0	per ton
English Bars, f.o.b. Dis. 1¼% & 1%	151	0	0	to	151	10	0	,,
Straits G.M.B., cash Warehouse, Net	149	15	0	to	150	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	148	5	0	to	148	7	6	,,
Australian, Mt. Bischoff, Warehouse, Net	150	10	0	to	151	0	0	,,

COPPER

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	68	15	0	to	68	17	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	68	17	6	to	69	0	0	,,
English, Tough, Cake & Ingot, Warehouses, Net	72	0	0	to	72	10	0	,,
English, Best Select, Warehouse Net	73	10	0	to	74	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	83	0	0	to	83	10	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	78	0	0	to	79	0	0	,,
Electro, Warehouse, Net	72	15	0	to	73	0	0	,,
Ore, ex. ship	0	12	3	to	0	13	3	per unit
Regulus, Matte and Precipitate, ex ship,	0	13	3	to	0	13	9	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6⅜	per lb.
Sheathing ,, ,,	0	0	6½	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	23	17	6	to	24	0	0	per ton.
Blende of 50 % Net	6	13	6	to	6	14	6	,,
Calamine, Net	6	16	0	to	6	17	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	14	5	0	to	14	7	6	per ton.
Spanish, ex ship, Dis. 2½%	13	17	6	to	14	0	0	,,
Lead Ore of 70 %, Net	7	2	6		7	5	6	

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	60	0	0	to	62	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	15	10	0	to	16	10	0	,,
Crude, ex ship, Dis. 2½ %	37	0	0	to	40	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	7	6	per flask
Italian ,, ,, ,,	7	5	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	6	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	1	0

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit :—

Digby Coal:		
Steam.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.		
High Hazel.		
London Brights, 4 to 8 in. cube	9	6
Bright Cobbles (Hand Picked)	9	0
Large Nuts, 2 to 4 in. cube	8	0
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0
Steam.—Top Hard.		
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per lb.
	Picric, Crystals	0	0	10	,,
	Tartaric at Manchester	0	0	10½	,,
Acetate of Lime:	Brown at Manchester net	8	10	0	per ton.
	Grey ,,	11	12	6	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, del$^{d.}$ U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	12	5	0	,,
Arsenic:	Best White Powdered net	12	5	0	,,
Bleaching Powder, 35%	,,	4	10	0	,,
Borax:	British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:					
Benzole, 50/90 %	,,	0	0	6	per gal.
,, 90%	,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C.	,,	0	0	6½	per lb.
,, ,, ,, 39/40° C.	,,	0	0	6½	,,
,, ,, Liquid, 97 99 %	,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b.	,,	0	1	8	,,
Creosote, ordinary good liquid	,,	0	0	1 7/16	,,
Naphtha, Crude, 20 % at 120° C.	,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b	,,	0	0	8	,,
,, ,, 95 % at 160° C. ,, ,,		0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,		0	0	10	,,
,, Rectified, flash point over 73° F. f.o.b.	,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b.	,,	0	1	0	,,
Naphthalene, all qualities.					
Pitch f.a.s. Manchester.	,,	1	7	6	per ton.
Copperas: Green, in bulk	,,	0	12	6	,,
,, barrels f.o.b. L'pool	,,	1	17	6	,,
Cake	,,	1	2	6	,,
Copper: Sulphate		21	0	0	,,
Cyanides: 98% minimum f.o.b. net		0	0	7½	per lb.
Lead: Acetate (Sugar) White, English		27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K		23	5	0	,,
,, ,, Grey		21	15	0	,,
,, ,, Brown at Manchester		16	15	0	,,
Nitrate		24	10	0	,,
Litharge, Flake		16	10	0	,,
,, Powder		17	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%		16	0	0	,,
White ,, ,, Dry ,, ,, ,,		17	0	0	,,
Naphtha (Wood): Miscible, 60 o.p.		0	2	6	per gal.
Solvent		0	2	7	,,
Potash: Bichromate... delivered England		0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull		18	5	0	per ton.
Caustic, 75/80 % ,, ,,		20	10	0	,,
Chlorate net		0	0	3 3/16	per lb.
Montreal in Store, Liverpool		31	10	0	per ton.
Prussiate Yellow net		0	0	4⅞	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
	,, ,, ,, Refined..... ,,	6	5	0	,,
	,, Carbonated, 48 %..... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) .....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % .....net	6	10	0	,,
	Caustic, White, 77 %..... ,,	10	12	6	,,
	,, ,, 70 %..... ,,	9	12	6	,,
	,, ,, 60 %..... ,,	8	12	6	,,
	,, Cream, 60 %..... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate ..... c.i.f. Hull net	16	10	0	,,
	Bicarbonate, in 1 cwt. kegs.....	6	15	0	,,
	Bichromate.....delivered England...	0	0	2¼	per lb.
	Chlorate ..... net	0	0	3 1/16	per lb.
	Nitrate.. ex quay Liverpool, ... ,,	10	0	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate .....net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts).....	1	12	6	,,
	,, (Saltcake, 95%).....	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers.....	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	9	0	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White.....	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports.....	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool 10½d.	per metallic unit.			
Ochre:	French JC ..... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).....c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

		£	s.	d.		£	s.	d.	
Copper,	Ores of, 10 to 25%	0	12	0	to	0	13	0	per unit.
	Regulus, 45 to 55%.....	0	13	3	to	0	13	9	,,
	Precipitate, 65 to 80% ...	0	13	4½	to	0	13	10½	,,
Tin Ores,	70 %.....	91	0	0	to	93	0	0	per ton.
Lead Ore,	70%					6	19	0	,,
Blende,	50%					6	9	6	,,
Calamine	.....					6	12	0	,,
Antimony Ore,	50%.....	20	0	0	to	22	0	0	,, nom.

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

			s.	d.	
Ord. 50%, ...f.o.b.	Porman		6	4	per ton.
Do. ..... ,,	Cartagena		6	7	,,
Special low phos. ,,	Porman		6	10	,,
Do. do. ,,	Cartagena.....		7	0	,,
Extra quality do. ,,	,, ...		7	6	,,
Special Iron Ore ,,	,, ...	nominal			,,
Specular 58% do. ,,	,, ...		9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	
Lower Ports Pine.....	,,	0	1	3		0	1	
Quebec Red Pine	,,	0	1	6		0	2	
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks.....	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	2	6		7	7	6
Nova Scotia Spruce..	,,	7	0	0		7	5	0
Spruce Boards.....	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak.....	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish..... ...	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.....	,,	0	1	2		0	1	9

Deals.

Red Archangel and Onega, 1st quality	per std	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics.*

15136. P. R. J. Willis, Kingston. July 24th.—Improvements in anti-friction bearings. (*I. A. George, U.S.A.*)

15154. S. Webster and E. J. Webster, London. July 24th.—Improvements in rotary engines.

15175. H. E. Newton, London. July 24th.—Improvements in centrifugal and similar pumps. (*H. R. Worthington, U.S.A.*)

15176. N. Staub, London. July 24th.—Improvements relating to boring bits.

15179. J. Guthrie, London. July 24th.—Improvements in speed-reducing gear.

15195. H. W. Webb, London. July 24th.—Improvements in speed indicators. (Date applied for, July 26th, 1904.)

15206. E. Haertel and A. Jensen, London. July 24th.—Improved construction of electrical resistance apparatus.

15236. J. Melotte, Birmingham. July 25th.—Improvements relating to the lubrication of vertical shafts.

RECENT SPECIFICATIONS.

AN IMPROVED ELECTRICAL HYDRO-PNEUMATIC GOVERNOR FOR MARINE ENGINES.

R. J. W. Grasset, South Yarra, Victoria, Australia. June 22nd, 1905.—This invention relates to an improved governor for marine engines, and has for its object the prevention of racing of the engines when the screw propeller rises out of the water in a rough sea, and which is extremely sensitive in its action upon the engine to which it is applied. In constructing a governor according to this invention, a pipe is fixed in a vertical position, contiguous to the keel, and in the extreme aftermost part of a screw steamer. The bottom of said pipe is in open connection with the sea, while the sea-cock remains open. The top of said pipe is carried to such height as may be found necessary, and is flanged. A solenoid is placed in the engine-room, the electric connection being carried through the screw shaft tunnel of a screw steamer. The lower portion of cap or dome is provided with a corresponding flange by which it is bolted to the top of pipe. An air-tight elastic india-rubber diaphragm is secured between the said flanges. A thin metal ring having cross bar, as shown in fig. 2, rests upon internal lugs provided for the purpose in the pipe, in order to prevent said diaphragm being too much depressed. The pipe is provided with an air-cock and drain-cock. The bottom of said pipe is flanged and bolted to a flanged connection on the sea-cock, which is fixed as low as possible in the aftermost part of a screw steamer. A metal spindle, fig. 1, having an extended flat base, rests upon centre of diaphragm. The said spindle is passed through a single or double spiral spring, placed within the cap or dome, and through the threaded gland, said gland being screwed into the upper part of cap or dome. The threaded gland, terminating with cap, is for the purpose of adjusting the compression of the spring to suit the depth of water the ship is drawing. An electric contact breaker in two parts connected by wire is carried on top of the spindle by an insulated piece. Said contact

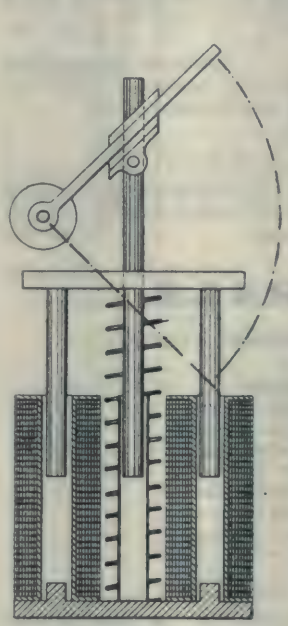


Fig. 3

Fig. 1

Fig. 2

breaker establishes an electric connection with the solenoid through contact pieces, said pieces being carried on the insulator. The magnet or solenoid draws down the cores with the bar and the vertical rod. This operation actuates the lever of throttle or other steam valve by the movable joint. When electric connection is broken by the rising of the spindle in the dome, the cores are raised by the action of the spring. In the accompanying drawings, fig. 1 is a sectional elevation of the pipe with the cap or dome, formed in two parts, as shown, and the related parts of the governor. Fig. 2 is a plan of the metal ring, and fig. 3 is a sectional elevation of the solenoid and its connection with the steam-valve lever in the engine-room.

IMPROVEMENTS IN AND RELATING TO ROTARY ENGINES, BLOWERS, AND PUMPS

R. Lee, Great Bookham, Surrey. June 17th, 1905.—This invention relates to rotary engines, blowers, and pumps, and provides a further improved, simplified, and more efficient engine of the annular or crescent-shaped chamber type, with two or more vanes hinged or pivotted to a rotary piston drum. Fig. 1 illustrates a transverse section. Fig. 2 is a central longitudinal section of a reversible engine embodying the improvements. Fig. 3 is a detail view of the valve gear looking from the right of fig. 2, and fig. 4 shows a modified form of the vane, drawn to a larger scale than that of fig. 1. In the improved engine each vane or piston is provided with a stop arranged in the position shown in fig. 1, that is to say, at that end of the vane remote from the pivot or axis of the vane, and adjacent to the inner surface of the vane. This stop co-acts with a relative or corresponding stop formed at the position shown on the wall of the recess in the rotary piston drum, and said stops conjointly prevent the vanes pressing unduly against the cylinder wall and so minimise friction and wear. Said stops also form fluid tight joints when in contact and prevent leakage between the vanes and the drum. The stop is preferably a separate detachable piece of metal as shown in fig. 4. It can thus be removed when worn and replaced by a new stop, thereby facilitating repair. A cylindrical inner surface is formed on each vane and this surface is in contact with the fixed cams secured to the end or cover plates of the cylinder. The shape of these cams, in combination with the co-acting surfaces on the vanes, is an important feature of the present invention; the cams are so shaped as to have their surfaces parallel to the faces of the working chamber and abutment, so that when the surface of the vane (shown in fig. 4) is in contact with the cams, the rounded edge will be in contact with the face of the working chamber or of the abutment. The face of the vane is cylindrical and is struck from the axis about which the vane oscillates. This face truly fits against the edge of the stop and thereby allows of admitting the working fluid at an early period of the revolution before the vane has passed the sloping face of the abutment. The sides of the vanes are packed by packing strips wedge-shaped in cross section lying in recesses in the vanes and pressed against sloping walls of the said recesses by springs. The invention also comprises an improved form of tappet motion for controlling the admission of the working agent to the working chamber; consisting of a tappet valve, the spindle of which is moved by either one of a pair of oppositely disposed levers of which carries a pivoted arm projecting into the path of a single tappet or cam, co-acting stops being arranged on the said arms and levers, whereby each arm is moved to open the valve, or swings idly aside, according to the direction of rotation of the said tappet or cam.

Fig. 1

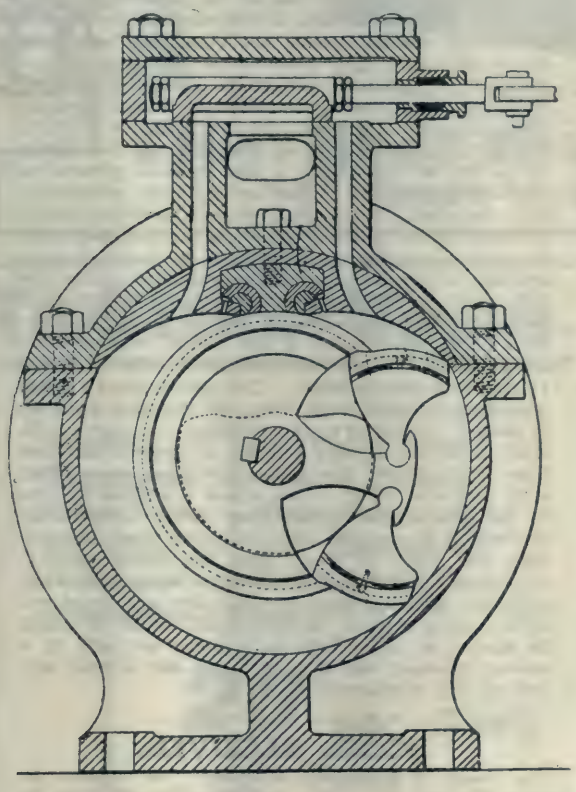


Fig 2

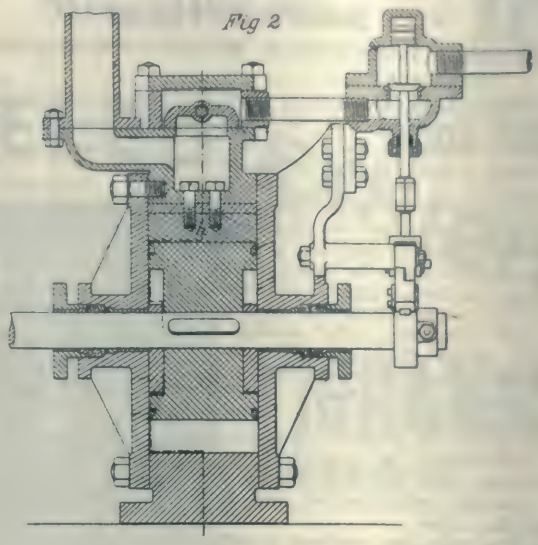


Fig. 3.

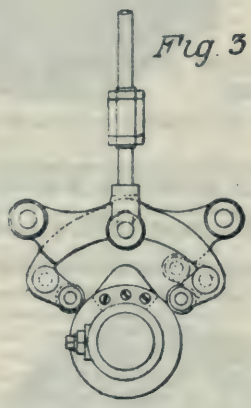
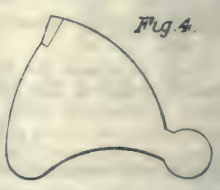


Fig. 4.



NEW PUBLICATIONS.

"THE LOCOMOTION PROBLEM."

By Charles Bright, F.R.S.E., M.I.E.E. P. S. King and Son. 1s. net.

Apropos of the recently issued report of the London Traffic Commission, Mr. C. Bright's three lectures should prove unusually interesting to all those who wish to make a study of the various projects formulated as a solution of the evils of overcrowding. Originally delivered before the Uxbridge Literary Institute, the first lecture deals with the amenities of the road, driving, speed, taxation, and the Motor-Car Act. The second lecture considers the characteristic advantages of motoring, road improvements, and the road problem generally. At the present time the third lecture will be found the most interesting; after dealing with traffic congestion, the writer thoroughly discusses the relative merits of automobiles, tramways, tubes and electric railways. In conclusion Mr. Bright maintains that rapid locomotion, though excellent in its way as a temporary palliative for present difficulties, tends as much towards centralisation as towards decentralisation; he is of opinion that the real solution will only be found in industrial redistribution and in the establishment of garden cities.

We have also received a copy of the same author's "Imperial Preferential Policy" which appears to be a comprehensive statement of the essential arguments for and against Imperial Preference.

"TECHNICAL EDUCATION IN EVENING SCHOOLS."

By Clarence H. Creasey. Swan Sonnenschein and Co., Ltd. 3s. 6d.

There seems to be no finality to discussions on technical education. The present work, however, is not so much concerned with the elaboration of an ideal curriculum, as it is to point out the defects in the present system of technical training in evening schools and to suggest the means of arriving at a more satisfactory method. The writer remarks that while any dispassionate observer must admit that in individual cases sound and meritorious progress is made, few will deny that this is accompanied by an enormous waste of money, time, and effort. One of the most pressing educational needs of the next few years, is to adapt the instruction to the capacity of a larger number of earnest students. Following the introduction by Principal Griffiths, who dwells upon the want of co-ordination between the secondary, evening continuation, and technical schools, the author deals with the nature and scope of technical education, pointing out some misconceptions and estimating its true value. In the second chapter he comments upon the fundamental problem of the continuation school, which is, of course, irregular attendance. The remedies he proposes sound a little drastic, but probably they would be none the less effective. The difficulties and shortcomings of evening technical instruction and the attitude of employers of labour are then discussed, and lead up to an important chapter on methods of instruction, in which the writer emphasises the desirability of judicious correlation. The concluding sections are devoted to the organisation of curricula and some special problems. The appendix contains some useful data on the cost of compulsory continuation schools, a note on mining instruction, and the provision of apparatus. To all those who are inclined to adopt a pessimistic view of the advantages of technical evening schools we earnestly recommend for their careful consideration the points raised in Mr. C. H. Creasey's most informing volume.

NEW CATALOGUES.

Hoisting Wire Ropes is the title of an admirably-produced booklet which has just come to hand from Messrs. Brunton and Son, of Musselburgh, Scotland, manufacturers of every description of Plough Patent steel and iron wire ropes. The firm gives some useful information on ordering wire ropes, when, of course the purchaser should specify if the dimensions given are diameter or circumference. The style of rope wanted should be stated, giving, if possible, the number of strands and number of wires in each strand. Sections of the more general constructions are illustrated in this list. The grade of rope should also be stated whether Crucible, Plough, or Monarch. Clients are advised that, if uncertain which will best answer their purpose, they should indicate what use the rope is going to be put to, and size of pulleys it has to run over, when the manufacturers will supply the style and quality best suited for the purpose.

Quaker City Rubber Company, 4, Lloyd's Avenue, London, E.C.—An attractive pamphlet just issued by the above company explains in detail the why and wherefore of Daniel's P.P.P. rod-packing, by means of which it is claimed that a large amount of the power wasted in overcoming rod friction can be saved. To quote from the description given, this packing, as our readers will remember, is composed of two wedges and a cushion, upon which the steam or other fluids, leaking through the neck-bush, and pressing upon the base of the inner wedge, produces a vertical and also lateral motion, sliding that particular wedge against its fellow, and therefore on to the rod. The material is built up and prepared so as to remain sufficiently pliable to permit of expansion and contraction, whether under pressure from the steam or freed from its influence. It is a self-setting packing, and operates only on that stroke of an engine when there is any pressure present on the stuffing-box end of a cylinder; as no pressure at all is supplied by the gland, it will therefore readily be seen that on the return stroke of an engine when the steam is on the reverse side of the piston there is nothing to press the wedges upwards and against the rod; they are therefore free to assume their normal position. We are informed that a steam hammer after being fitted with it ran (with the valve set open as was usual with ordinary solid packing) 15 strokes a minute faster. This would mean a given percentage of extra work done with the same quantity of steam. In the case of a colliery, the cage in the shaft made its allotted journey in some 20 sec. less time than before the winding engines were fitted with Daniel's P.P.P. This would doubtless be due to the absence of the retarding action of the solid packing on the engine rods, and thus cause them to take less time to reach their maximum velocity. A steam hammer also was able to be put to work while the steam pressure on the boiler only registered 25 lb; previously it needed 40 lb. before it could be moved at all. These facts point not only to a saving of power and of money, but also of wear and tear of the machinery.

BOOKS RECEIVED.

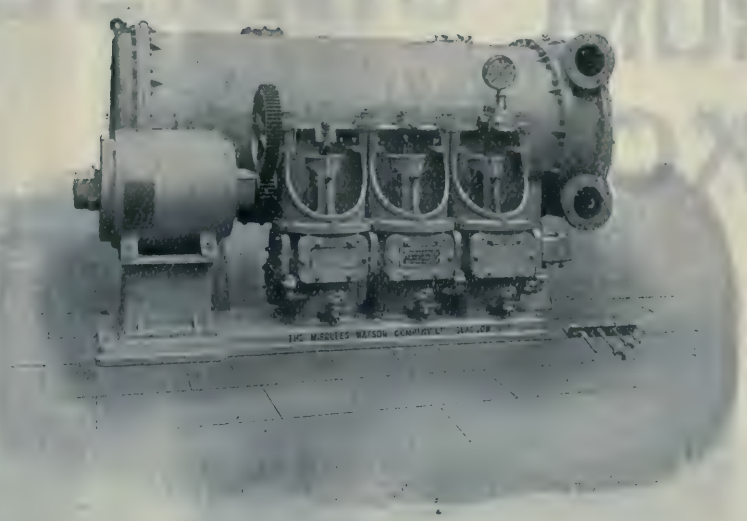
"The Theory of Experimental Electricity." By William Cecil Pampier Whetham, M.A., F.R.S. Cambridge University Press. 8s. net.

"Elements of the Mathematical Theory of Electricity and Magnetism." Cambridge University Press. 10s.

"Electric Traction." By Robert H. Smith. Harper Brothers. 9s. net.

PAGE'S WEEKLY — Miscellaneous

PAGE'S WEEKLY — Engines, &c.



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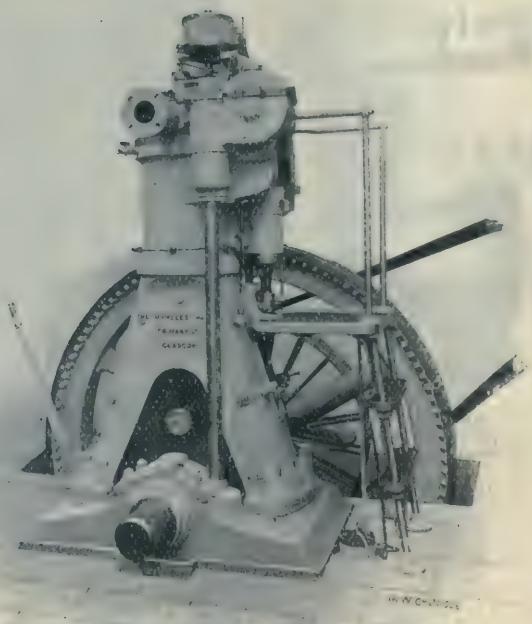

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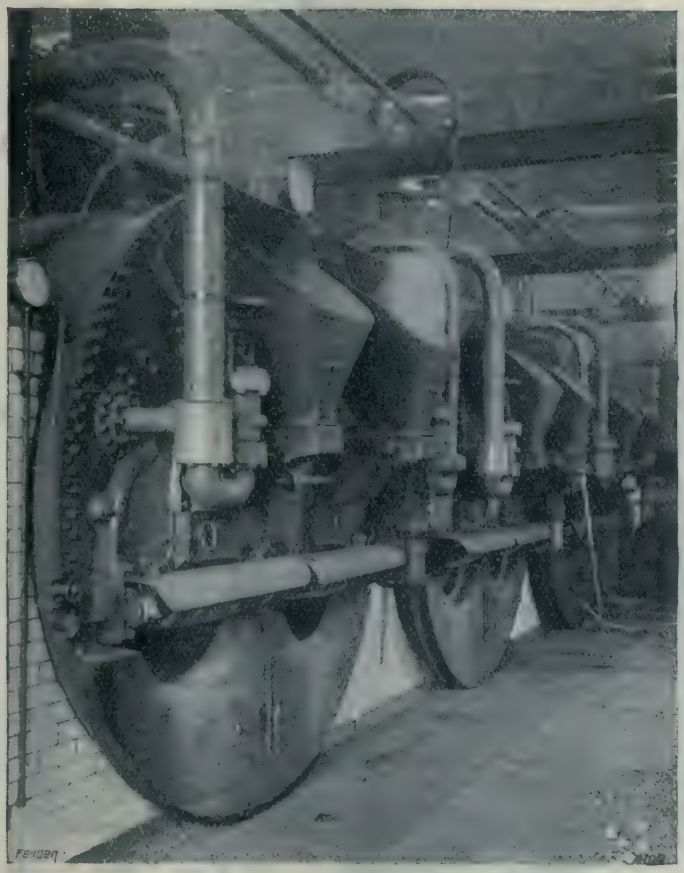

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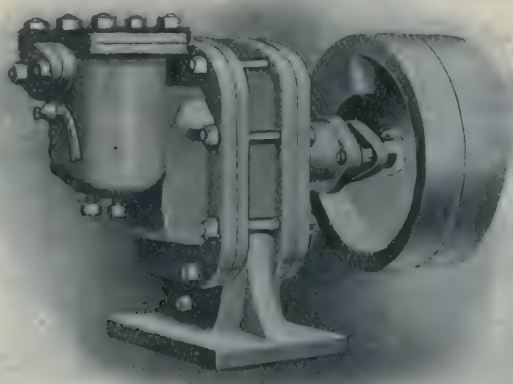

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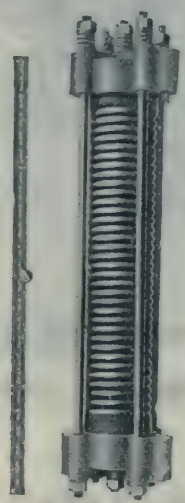

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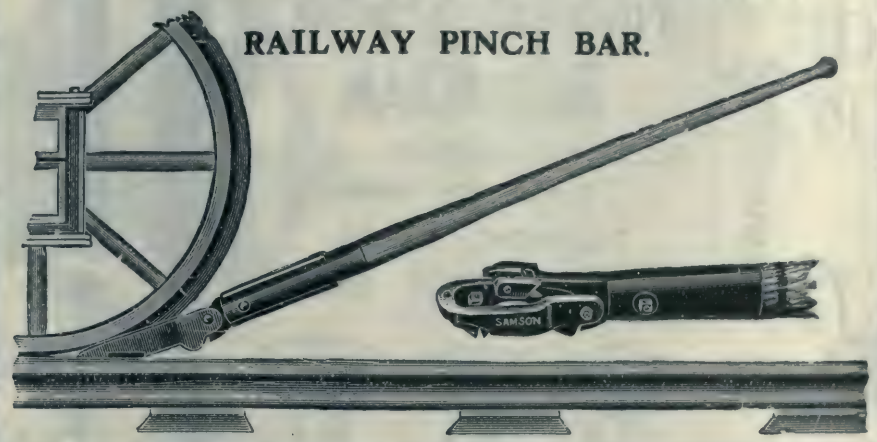

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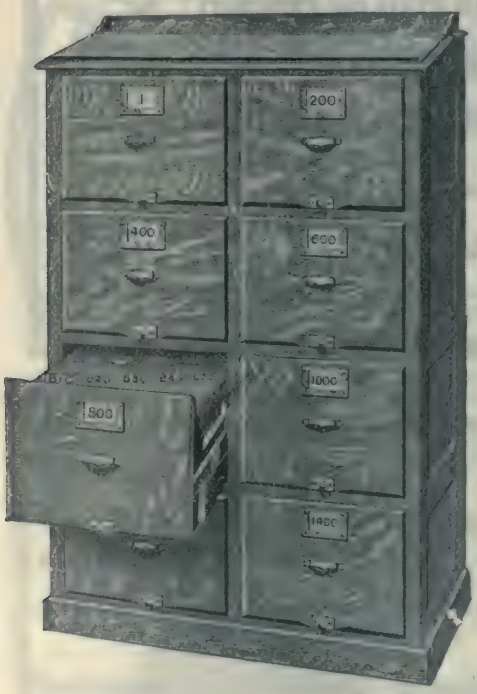
PAGE'S WEEKLY Electrical Apparatus

PAGE'S WEEKLY **Printing, &c.**



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PAGE'S WEEKLY

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